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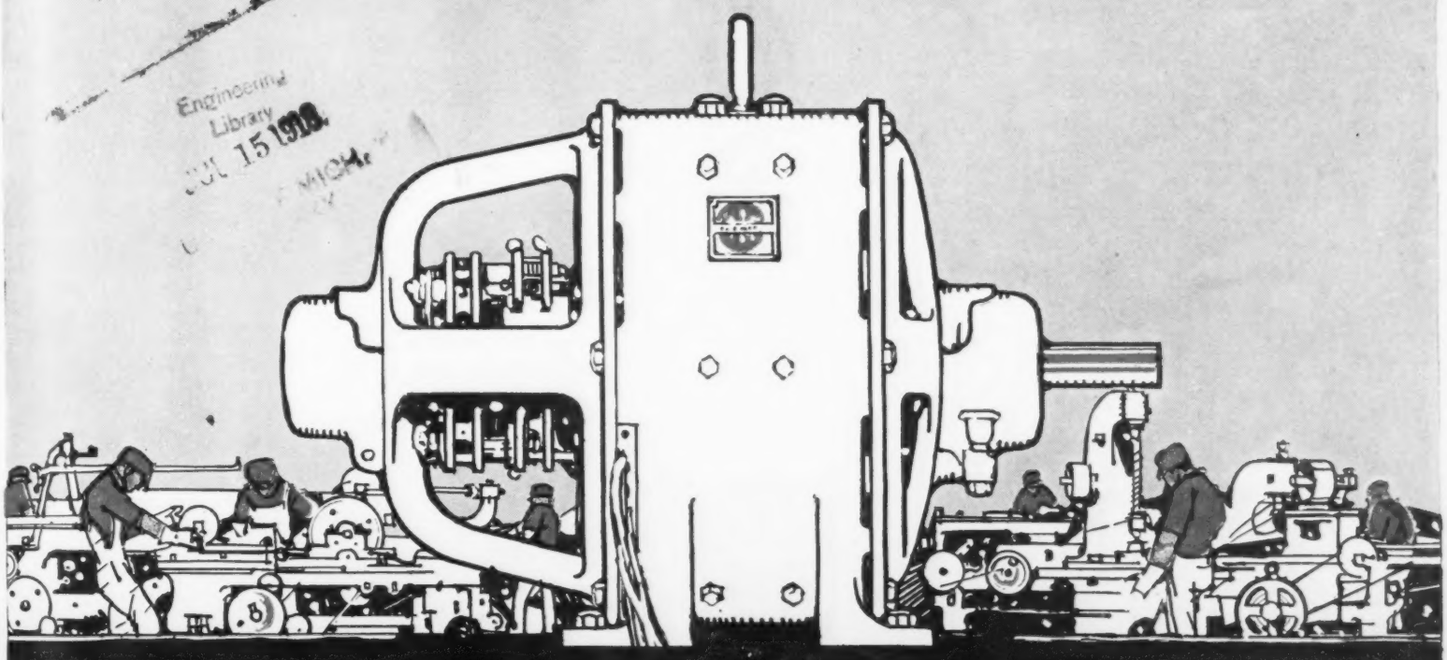

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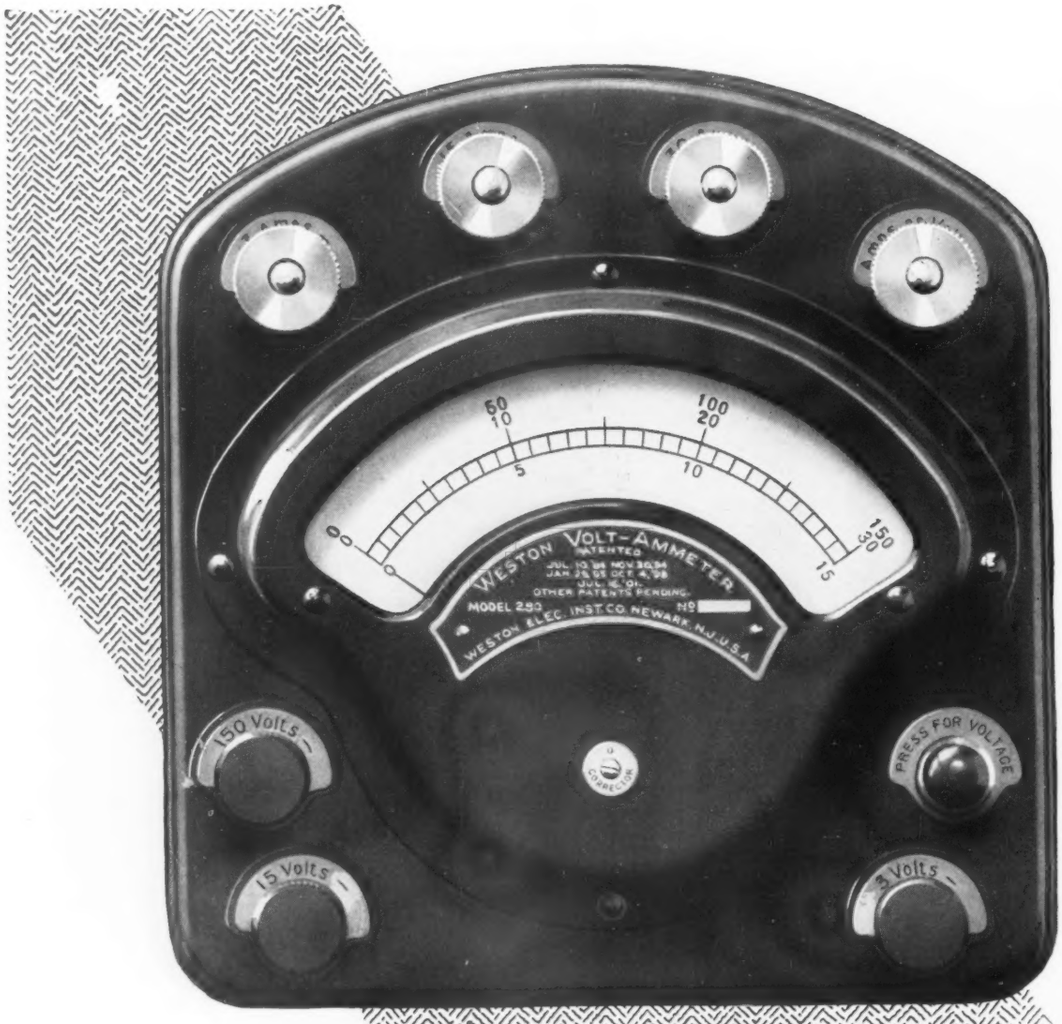

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Electrical World

F. M. FEIKER, *Editorial Director* W. H. ONKEN, JR., *Editor*

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Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

Volume 72 New York, Saturday, July 13, 1918 *Number* 2

Service for the Electrical Engineer

BOTH President Rice and President-elect Adams in their addresses at the recent convention of the American Institute of Electrical Engineers touched on the present and future work of the electrical engineer. The thought expressed was that in these abnormal times and in the period to follow the function of the engineer is primarily an economic one. So far as efficiency of conversion is concerned, much electrical apparatus has already attained practical perfection. The immediate task, therefore, does not contemplate any increase in the efficiency of electrical apparatus so much as it does the application of that apparatus to the conservation of material and labor and to the winning of the war. There has been during the last year rapid advancement in that direction due to the imperative demands for economy in coal, saving of money and increased efficiency of production. Happily, the electric generating systems of the country had been developed and planned so wisely that when the nation found it necessary to create or enormously expand industries for the production of ships, armament, munitions, etc., the power to operate these was not wanting. The same foresight and skill displayed in the creation of our power stations and vast transmission networks will still be needed, however, and to a much larger degree, after the war; for what we have acquired through a process of evolution may have to be applied so broadly and so hastily as to suggest revolution.

Electrical engineers, as Professor Adams has well said, have tied the four corners of the earth together before their inhabitants have learned how to live together. Time and space have been eliminated, but human beings with their passions, race prejudices, systems and institutions remain. The present war, we firmly believe, will serve to check these passions, and by effacing tyranny will see a regenerated and better world when peace is declared. For that day the electrical engineer should now prepare. Needless to say, his opportunities will be exceedingly great, for the world, exhausted and impoverished, will turn to the engineer for help. He who can render industry more productive and more efficient, who can apply practical science to world use, will increase his personal value by every kilowatt which he controls. But to do this requires expanded vision and broader sympathy in human affairs. The engineer is indeed the hope of the nation both now and hereafter, as President Rice has said. It is up to him to a very considerable degree to help by scientific methods to solve the problems which will confront us. We are therefore heartily in accord with the suggestion of Professor Adams that the scope of the work of the American Institute of Electrical Engineers should be restricted in one direction and expanded in another to give the service most needed at this time by the nation and the world.

More About High Pressures

ESKIL BERG'S paper on this topic gives concrete evidence of the drift of opinion and practice regarding high steam pressures and superheat. We have been preaching this doctrine for years, but improvements come slowly, particularly where the trend of industrial conditions has been in the direction of standardization rather than bold experiment, and it is only within a very few years that material progress has been made. The spur of costly fuel under war conditions is now leading to important results. Mr. Berg points out that in turbine design conditions have reached a plane of efficiency where the only hope of material gain is in increasing the temperature range. This implies higher steam pressures, higher superheat or both. In theory the gain by going from 200 lb. to 500 lb. boiler pressure (14.1 kg. to 35.15 kg. per sq.in.) supplies a saving in fuel of between 14 and 15 per cent, amounting in cash in a plant burning five-dollar coal at the rate of 900 tons a day to no less than $200,000 a year—a figure not to be sniffed at even in these days of large reckonings. Superheat in itself makes a smaller direct thermodynamic gain, but is much more easily applied and also reacts favorably on the efficiency of the turbine itself. This is due chiefly to the removal of the moisture in the steam, cutting down the friction and windage loss in the turbine, which is far bigger than all the other losses there combined.

To obtain the best results high steam pressure and superheat together should be utilized. The present over-all efficiency, including the generator losses, in a high-grade turbine with boilers worked at top efficiency is a shade better than 20 per cent. Mr. Berg indicates that an over-all efficiency of more than 30 per cent is obtainable without particular difficulty if one goes to high pressure and superheat, and also emphasizes this result by suggesting that the cost of high-pressure equipment may turn out under such circumstances to be even less than that of the standard equipment now used.

The chief objection to a radical movement upward in pressure and temperature lies in the fact that boilers, piping and auxiliaries to meet the new conditions are

not standard, precisely the same line of reasoning by which the old atmospheric pressures were defended three generations ago. From a practical standpoint the real difficulty is that at the present time under war conditions it is pretty nearly impossible to procure the manufacture of anything out of the ordinary line, save as the excursions may be in the direction of things immediately necessary for war purposes. This objection will remain valid only while we are in the fight, and is no excuse for the abandonment of judicious experiments, making ready for work on a large scale when the present stress is removed.

Supply Raw Materials for Electrical Manufacturers

IN THE production of highly essential materials sorely needed in the vigorous prosecution of the war the electrical manufacturing industry has a large and patriotic work to do. We believe that still more will be required of the industry in the future. Like some other great branches of trade, the electrical manufacturing industry serves the nation not alone by producing munitions but also in a very important way by continuing to make the necessary quantities of regular apparatus and supplies. Without the steady production of such regular lines of products in enormous volume the entire national manufacturing program, whether directly or indirectly connected with the war, would be irretrievably delayed. Therefore it is in the direct and vital interest of the whole country that electrical manufacturers shall not be allowed to slow down their normal activities in essential lines.

The standpoint of the manufacturers on the subject of their war-time needs has been expressed in recommendations to the War Industries Board, as published in the ELECTRICAL WORLD of July 6, page 23. These touch the timely questions of preference listings for the supply of indispensable steel products, priority certificates to assure steel supply, and the co-ordination of whatever arrangement is made for steel with that for other raw materials. They are the heart of the immediate problem. From the handling of this matter can come either an orderly, dependable arrangement for making the supply of steel adequate to the war demands upon electrical manufacturers for their products or grave confusion and the dislocation of manufacturing and labor conditions. Without doubt the War Industries Board must make its decisions inflexibly on the basis that strict war calls come first, although there is abundant indication that the authorities will be prudent in trying to convert industries to war uses rather than let public distress or unrest grow from abrupt curtailment of industrial activity. Its conclusions, however, will probably have to be tempered by the well-recognized fact that supply of steel is bound to be seriously short, that the amount called for by the purely munitions program is stupendous, and that other industries are clamoring that their requirements, whether deserving of consideration or not, shall have recognition.

The conditions developed in the electrical industry by time, competition and the economic testing of methods are comprehended in two points which the manufacturers have taken to the War Industries Board for discussion. One is the desirability of securing steel so that the manufacturers may not only follow their regular policy of producing in quantities for stock but may furthermore be protected by an advance supply now in order to lessen transportation troubles next winter. Barring the possibility of a grave war crisis or other exigency bearing on the energetic prosecution of the war, we feel that the electrical manufacturers are entitled to this aid in pushing their manufacturing programs. In the nature of their business they cannot produce most lines merely on the basis of definite orders received. They have to produce ahead to some extent, forecasting requirements in order to be ready to comply promptly with the needs of industry. This is true of both apparatus (excepting large units) and supplies.

There is a direct relation between the question of manufacturing for stock and the question of distributing through jobbers. The War Industries Board rightly recognizes the function of the jobber as economic. You cannot both have the invaluable distributive service of the jobber and at the same time refuse to supply him with the stock which alone enables him to give immediate delivery. It is not possible to withhold steel from the electrical manufacturers and at the same time to find badly needed electrical supplies in the jobbers' warehouses throughout this extensive country. The jobber provides an economical, useful means of distribution which is of large advantage to the government in saving time and waste in the tremendous engineering and construction outlay incident to the war. Faith in the government gives us confidence that the problems, which directly involve the maintenance of the electrical manufacturing industry as a powerful industrial force, will be met as equitably by the authorities as the war necessities permit; but in the process of meeting them time, which is the essence of victory, should not be whiled away.

Industrial Motor Control

THE evolution of motor-control apparatus and practice is an interesting phase of electrical development. It has gone through many stages, and its present status is excellently set forth by Prof. C. E. Clewell in an article in our current issue. In certain respects motor-controlling devices have been simplified greatly since the early days of the art. In the beginning the electric motor was a peculiarly tender piece of apparatus both electrically and mechanically. The control of sparking was very imperfect, the insulation was none of the best, the slotted armature was unknown, and above all the motors in small sizes were commonly installed on lighting circuits of meager capacity so that their effect was unpleasantly conspicuous. Under such circumstances motors had to be installed where the brushes could receive constant attention, a precaution doubly necessary if any attempt were made to introduce variable speed. The starting rheostat had to be provided with many steps, and it behaved rather badly at that. Remote control, current-limiting devices other than open fuses, sometimes replaced by wire nails, and low-voltage automatic stops were quite unknown.

Professor Clewell's article is a study of an important

A. I. E. E. paper dealing particularly with control of small motors, especially direct-current motors. It is apparent from the facts brought out that great changes in the way of simplifications have been made. The complicated starting rheostat can now be brought to a most elementary form, even down to a single step of resistance variation, and it is indeed not very unusual to omit the external starting resistance entirely. It is well to look a bit into the cause of this now justifiable change in practice. In the first place, direct-current motors are much better designed with respect to sparking than they were in the old times. A first-class modern motor will stand all kinds of speed changes and changes of load with never a blink at the brushes, so that rheostatic control to avert commutator trouble at starting or in changing speeds is rather unnecessary. Second, the individual small motor here discussed is so trivial an element on the average electric system that it can be switched on or suddenly loaded without any perceptible effect on the system. A 10-hp. motor across the outside of a three-wire system is no longer a cause of worry to the station operator or to its own operation. This is one of the beneficial results of sheer magnitude in the scale of operations—that it takes 100 hp. or so to bear the same relation to the system operation as 5 hp. or 10 hp. a quarter century ago. Again, those who buy and use motors are much less fussy about some of their characteristics than in the early days.

Electro-Thermal Lightning Arresters

THE ordinary spark-gap lightning arrester in its simplest form is a device that has been used for the protection of signaling circuits over a period of at least sixty years. When connected between line and ground it forms an electric relief valve of a very simple but effective nature. Unless the lightning discharge passing over the gap is so powerful as to injure or deflagrate the metallic spark points, the device may continue to be serviceable for an indefinite period of time.

When the simple spark gap was first applied to active electric lighting and power circuits it was soon found to be defective. The moment that the lightning spark discharge occurred at the gap the conducting stream of ionized vapor formed by the discharge permitted the working voltage of the system to follow up with a vicious arc. This arc in most cases speedily wrecked the device and often short-circuited the system. It became necessary to add to the device some element which, while not interfering with the lightning discharge or jump spark, would suppress the dynamo arc very speedily. The Thomson magnetic blow-out has been a widely used accessory of this kind, especially for working pressures below, say, 1 kv. For use with higher pressures electrolytic protectors have been developed. These interpose an electrolytic counter-emf. approximately equal to that of the working voltage in the system and so prevent the formation of a dynamo arc at the spark gap.

The article by E. O. Schweitzer, beginning on page 52, deals with certain defects that may occur in an electrolytic lightning arrester and with devices intended to obviate them. If the electrolytic arrester fails for any reason to suppress the dynamo arc very promptly, it becomes heated and thereby weakened, so that it may even break down and become destroyed. To guard against this contingency an electrolytic cylinder is inserted in series between the electrolytic arrester and the spark gap. The cylinder is of bakelite, with metallic ends, through which pass metallic rods terminating inside on carbon electrodes of special forms. The cylinder is partly filled with electrolyte and is provided with an escape pipe into a reservoir of electrolyte and also with a needle valve relieving into the air. If the flow of dynamo current through the arrester, cylinder and spark gap is excessive, the heat within the cylinder, generated electrically, will force out the electrolyte into the reservoir until the upper electrode is denuded and the discharge circuit thereby opened.

The development of the electrolytic cylinder, as an adjunct to the electrolytic arrester, appears to have been so successful that it is now contemplated to develop it to the point where the electrolytic arrester can be eliminated altogether if possible, and to depend entirely on the electrolytic cylinder as the arrester, in conjunction with the spark gap. This is equivalent to promoting the cylinder from a subordinate position to one of complete responsibility for arresting the arc. It will be interesting to see how far this plan can be carried successfully.

It will be remembered that in some European power stations using three-phase pressures which in this country would be called moderate each of the three busbars in the central station is sometimes steadily connected to ground through a narrow column of slowly escaping tap water. Each column is contained in an insulating cylinder, and the steady flow of water through this cylinder is relied upon to keep the temperature low and the electric leak insignificant. In these cases the spark gaps are sometimes eliminated entirely, thus providing a liquid path to ground from each conductor for all accidental surge or lightning discharges. This is in one sense the antithesis of the Schweitzer method, because the latter depends upon suddenly developed heat for the operation of the device to clear the circuit.

The Coming Issues

HOW present conditions have affected cost of line construction, the advisability of overhauling water turbines during low-water season to secure the maximum economy later, and a method of calculating the hot-spot temperature in transformer windings will be among the subjects which will be discussed in coming issues of the ELECTRICAL WORLD. Other articles will dwell on methods of storing fuel to tide over the coming winter, increased necessity of basing rates on maximum demand and how to determine it, and characteristics of solid and stranded steel wire. The next industrial-control article will refer to the application of relays to motor circuts.

New Principle for Lightning Arresters

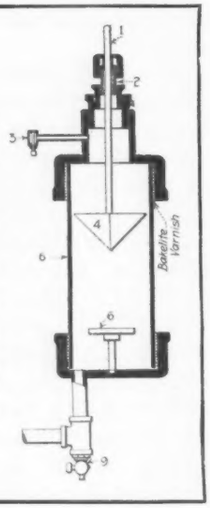
Preliminary Tests of an Electro-Thermal Valve Indicate Important Development in Lightning-Arrester Design—Performance of the Valve at Different Voltages Is Shown Diagrammatically

BY E. O. SCHWEITZER
Chief Testing Engineer Commonwealth Edison Company

THE electrolytic lightning arrester is designed to protect electrical machines, transmission lines and other equipment from the evil effects of high-voltage, high and low frequency discharges and surges, whether these originate from lightning or from some source in the electrical system itself. As a rule, the arrester is remarkably effective for this purpose, but, under sustained conditions, supplementary protection may be employed to advantage. A long sustained high-voltage surge, or a series of frequently repeated surges, may raise the temperature of the arrester to such an extent that the hot electrolyte will dissolve the active film from the arrester cones, thus reducing their resistance. For the protection of the arrester under these conditions the writer has conducted preliminary experiments on a device of his own invention, which is designed to open and close or vary the resistance of the arrester circuit automatically at any time when it is in danger. The possible use of the electro-thermal valve, as this device is termed, as a complete lightning arrester, entirely obviating the use of an arrester of the ordinary type, is indicated by the experimental data. A series spark gap is here required as for other arresters. The electro-thermal valve is shown in Figs. 1 and 2.

FIG. 1
CROSS-SECTION OF ELECTRO-THERMAL VALVE

It consists of a vertical cylindrical chamber made of a bakelite tube (5) closed at the ends by cast-iron caps. The upper adjustable electrode (4) is of artificial graphite in the shape of an inverted four-sided pyramid supported by a steel rod (1), through which it makes electrical connection with the high-potential circuit to be protected. This rod passes through the stuffing-box (2) in the upper cap, in which it can be moved, when desired, to vary the distance between the electrodes. The lower electrode (6) is a flat plate of artificial graphite, permanently attached to the lower cap, which is grounded. So far ordinary city water has been used as the electrolyte. The chamber is provided with a small relief valve (3) and is also connected by a pipe to a reservoir by means of which a certain desired pressure is maintained in it.



The heat generated by the flow of current following a discharge through the electrolyte produces a pressure in the electrolytic chamber. This pressure is only partly relieved by the small valve, and in the meanwhile the resistance of the electrolyte decreases as its temperature rises, so that the current increases rapidly. Then the area of contact between the electrode and the electrolyte becomes less and less as the electrolyte level goes down, since the electrode tapers to a point. The decreasing area of contact results in an increasing contact resistance and the current drops rapidly, although smoothly. Despite the decrease in current, heat is now being generated at a high rate at the contact surface, and the electrolyte is forced rapidly downward until contact is broken at the point of the electrode and the current becomes zero.

The needle valve now relieves the pressure, and if the impressed voltage has been removed the electrolyte will return rapidly to its original level. If, on the other hand, the impressed voltage has been maintained at its full value, the electrolyte rises only to a point where it makes contact with the tip of the electrode. This contact is so small and of such high resistance that the production of heat is exceedingly rapid, the pressure quickly rises, the electrolyte is immediately forced down out of contact with the electrode, and the flow of current is but momentary. This last cycle is repeated over and over again so long as the impressed voltage is maintained, resulting in a momentary flow of current at brief intervals.

The higher the impressed voltage, the more rapid the operation of the valve, since a high voltage results in a large flow of current and a rapid generation of heat. If the impressed voltage is sufficiently low, a small flow of current may continue indefinitely without causing the valve to function. Other conditions remaining constant, the distance between electrodes governs the electrical resistance of the valve, and thus the magnitude of current flow. If the distance is short, the current flow will be large and the operation of the valve rapid. As the distance is increased the time required to open the circuit becomes greater.

If the distance between electrodes is very short and the impressed voltage high, an arc might form and maintain itself from the electrode after the electrolyte had been forced out of the way. This can happen only in case the normal voltage of the power line is sufficiently high to form an arc across the gap, since the duration of a disruptive discharge is too brief to cause such a result. The limiting electrode distances for different voltages have not yet been determined, and no such arc has ever formed during the course of our experiments.

The current-carrying capacity of the device may also be greatly increased by reducing its resistance. Increasing the cross-section of the electrolytic chamber and at the same time increasing the size of the electrodes will also increase the valve's current-carrying capacity.

Adjusting the needle valve to have a greater orifice decreases the speed of operation since the needle valve then prevents the pressure from building up so rapidly as before, and when the circuit has once been opened the electrolyte will re-establish contact with the upper electrode in a shorter time than before, since the needle valve will release the accumulated pressure more rapidly. The needle valve must be set at the point which will give

the desired balance between speed of initial operation and speed of return to initial position, and then be locked in place.

PERFORMANCE OF VALVES AT DIFFERENT VOLTAGES

An approximate idea of the speed at which the electro-thermal valve operates at different voltages and the current which it carries can be obtained from the curves shown in Fig. 3. These show the experimental results obtained at 220 volts, 600 volts, 1050 volts and 2200 volts, these voltages in each case being impressed directly across the electrodes without the use of limiting resistance of any kind. At the beginning of each run the valve was at room temperature and the impressed voltage was maintained at its full value for ten minutes. The electrode distance was 3 in. (7.62 cm.) in each case.

At 600 volts the current climbed from an initial value of 0.55 amp. to 1.80 amp. in four minutes and thirty seconds. From the maximum the current dropped abruptly to zero in about two seconds. After remaining at zero for a few seconds the current began to rise again, at first rapidly, then more slowly, finally reaching a maximum at about the same value as before, whence it again dropped abruptly to zero. This cycle was repeated over and over again up to the end of the run, but each cycle was of briefer duration than the one before it.

It will be noted also that after the third cycle the current remained approximately constant at its maximum for several seconds. By this time the electrolyte was very hot and its resistance low, resulting in a tendency for the current to reach a higher maximum than before. This tendency was opposed by the fact that the pressure above the electrolyte also increased more rapidly than before. At the maximum value of the current these opposing tendencies exactly balanced each other for an appreciable time, thus holding the current constant.

The operation at 1050 volts was quite different. Starting at an initial value of 1.25 amp., the current increased more rapidly than before to a maximum of 2.80 amp., which was reached in one minute and thirty seconds. The point of inflection in the curve is still noticeable but less distinct than before, because the action is now more rapid. As before, the current dropped abruptly from its maximum to zero. After a brief interval it rose again—not to the former maximum this time, but to about 1.75 amp., dropping immediately to zero. Thereafter the current did not at any time exceed 0.25 amp., a value which it reached intermittently until the end of the ten-minute test, at periods varying from about five seconds at the beginning to about two or three seconds at the end.

At 2100 volts the current rose very rapidly from an initial value of 2.2 amp. to a maximum of 5 amp., which it reached in twenty-five seconds. It then dropped abruptly to zero as before. This time the action was so rapid that no point of inflection can be observed in the ascending curve. After the circuit was first opened, at the end of twenty-five seconds, the current never again exceeded a value of about 0.5 amp. Up to the end of the ten-minute run the electrolyte made contact with the electrode tip at intervals of three to four seconds. At each contact there was a momentary flow of current, about 0.5 amp. in value, which dropped to zero again almost instantly. For the sake of simplicity, the curve sheet does not show these rapid alternations of current from zero to 0.5 amp. after the first minute, but they continued substantially as shown during the remaining nine minutes of the test.

It is interesting to note that the flash of the arc each time contact was made and instantly broken could be distinctly seen through the ⅛-in. (3.17-mm.) bakelite-fiber wall of the electrolytic chamber.

The variation of electrical resistance during the four runs described is worth noting. Calculated from the observed values of voltage and current, it was as follows:

Impressed Voltage	Initial Resistance, Ohms	Resistance of Maximum Current, Ohms
220	.....	880
600	1,080	333
1,050	840	375
2,100	955	420

The resistance of the electrolyte itself decreases uniformly as the temperature increases, but the contact resistance between the electrolyte and the electrodes, always a considerable percentage of the total and sometimes the governing factor, varies according to the impressed voltage and other conditions in a manner which is rather obscure and does not lend itself to accurate prediction.

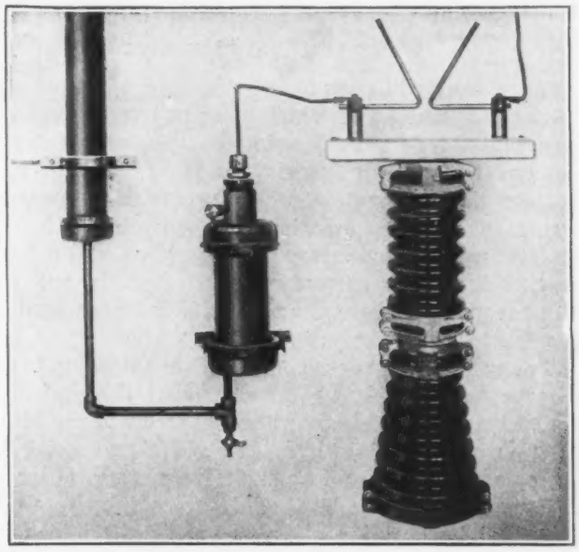


FIG. 2—APPARATUS ASSEMBLED AS COMPLETE ARRESTER
The electro-thermal valve is shown between spark gap and reservoir, both of which are essential parts of the arrester unit.

Other tests, made at various voltages, served merely to corroborate the results obtained in these four tests. No sustained test has yet been made at a voltage higher than 2100, as the laboratory equipment has been found to be inadequate above that point. Tests at higher voltages should be made at some location where a greater power capacity is available, so that the current drawn by the valve will not pull down the voltage of the line.

After some twenty or more separate runs had been made, the interior of the electrolytic chamber was inspected and found to be in perfect condition, despite the constant and rapid succession of high-voltage arcs which had been formed and broken during the tests. The upper electrode, which had acted as one terminal for these arcs, was as smooth and unpitted as it had been

originally. The bakelite tube, the lower electrode and the cast-iron caps all appeared to be in perfect condition.

No test has yet been made to determine how adequately the electro-thermal valve will take care of a disruptive discharge such as that caused by lightning. All tests so far made merely indicate how the valve will operate from the moment the power current begins to follow the disruptive discharge. Special tests should be made to determine the effect of such high-voltage, high-frequency discharges as result from lightning and system surges.

The experiments outlined for immediate execution include tests to determine the characteristics of the valve at voltages up to 6000 or possibly higher. Various electrode distances will be tried at different voltages, and readings will be taken of time, initial current and maximum current. Other determinations will be made to establish the relative influence of the different factors such as needle-valve orifice, dimensions of chamber and electrodes, distance between electrodes, composition of electrolyte, etc.

What the Tests Indicate

These tests will show the relationship, one to another, of the various factors which must be considered in the design of the electro-thermal valve. The device at present under test was not designed; it was built by guess because the information necessary for design was not available. Such information will be available when the tests at present under way are completed, and a larger unit, with higher current-carrying capacity and suitable for use at higher voltages, can then be designed and constructed with some degree of precision.

Two points in the development of the device up to date deserve mention. It was foreseen that the electrolytic action between the electrodes would result in the decomposition of water into hydrogen and oxygen, and that these gases would form an explosive mixture above the surface of the electrolyte. This expectation was later confirmed by draining off some of the gas into a test tube and igniting it. To prevent the possibility of an explosion in the electrolytic chamber, which might occur when an arc forms at the moment the circuit is broken, the electrolyte was covered with a layer of transil oil. No explosion has occurred, but it is doubtful whether the presence of the oil is really necessary. The quantity of gas formed during the brief flow of current must be rather small, and, furthermore, it is greatly diluted by a larger quantity of water vapor, which would tend to prevent an explosion of any violence. An attempt will be made to operate without the oil which has so far been used.

Although the electro-thermal valve was originally proposed for use in series with an aluminum arrester, for the purpose of protecting the latter from destruction, it soon became apparent that if the electro-thermal valve could be made suitable for this purpose it would be equally suitable for use as a self-contained lightning arrester, without any assistance from the aluminum arrester. Such inherent limitations as it may possess are equally serious whether we connect it in series with an aluminum arrester or install it as a lightning arrester.

From the preliminary experiments so far completed it is evident that the electro-thermal valve possesses peculiar qualities which are advantageous in a lightning arrester. Connected from ground, through a horn gap, to a power line, it will promptly extinguish the power arc at the gap, following a disruptive discharge. It will at the same time afford complete protection to itself from any possible ill effects resulting from the flow of power current. It is probable that the device can be so designed for a power line of any given voltage as to interrupt the flow of power current within five seconds after an arc forms at the gap. This much may be said with a fair degree of confidence. It remains to be determined whether this device will provide a sufficiently easy path to ground for high-voltage disruptive discharges, and whether it can dispose of such discharges without injury to itself.

That the electro-thermal valve can be so constructed as to carry current from a high potential to ground over a very wide range of voltage conditions is evident from the curve sheet already discussed. It is theoretically possible to design the device in such a way that

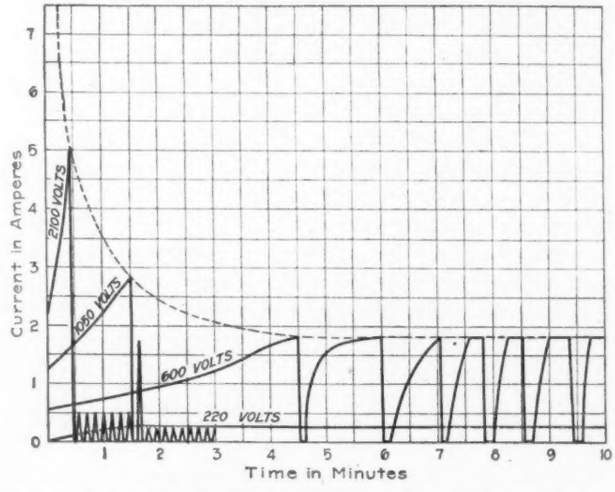


FIG. 3—TIME CHARACTERISTICS OF ELECTRO-THERMAL VALVE

Tests made with device of given dimensions showing action at various voltages. Shows only the action in interrupting dynamic currents.

any one of the four operating curves there illustrated can be duplicated at any predicted voltage, no matter how high. To duplicate, at 100,000 volts, the curve marked 220 volts on the sheet would merely require a device of huge dimensions. This, of course, is an extreme which is neither practicable nor desirable, but it serves to illustrate the remarkable flexibility of the device in this respect, a flexibility which can be utilized to advantage within more reasonable limits.

If, after further test, the electro-thermal valve is found to possess in sufficient degree the other qualities required of a good lightning arrester, its possible field of usefulness should be very wide. It would be very much cheaper in first cost than the ordinary arrester and would not require any charging, frequent inspection, skillful attendance or delicate handling. By virtue of these advantages it might be expected to replace existing types of arresters to a considerable extent, depending upon how nearly it equals the quality of performance of these types of arrester. It might also replace the many types of cheaper arresters under conditions where a highly effective arrester is desirable.

Work of the Engineering Council

Many of Its Activities Are Directly or Indirectly Connected with the War and Helpers Are Wanted Who Can Give Time to Assist the Committees—Consideration of the Licensing of Engineers

THE Engineering Council, as was designed, is engaging in many activities for the engineering profession of America, many of these being directly or indirectly connected with the war. The council is a body of representatives from member societies conducting most of its work through committees. For effectiveness these committees have usually a small number of members, although committee membership is not limited to the representatives on the Engineering Council.

As the work of some committees develops, however, there are occasions when helpers are needed who can devote time to details, to special investigations, to getting local information in some community or state, to compiling and analyzing of information already accumulated, or to scouting for men needed for some particular service. When need arises for such assistance it is often difficult to think of or to find the right man available at that moment. In order to meet this difficulty, to give a larger number of engineers a share in the activities, to broaden the council's contact and gain greater breadth for its views and statements, as well as to make its work more widely known, the Engineering Council is requesting engineers who can help to write to the council's office registering their names and addresses and in a general way stating the extent and nature of service each is willing to render. This is an opportunity for some of the younger members of the profession to take a hand in society activities, but the request is not limited to the men of few years.

The public affairs committee reports on matters of public policy and those relating to national, state or local government, other than technical questions.

The American Engineering Service has the duty of compiling as complete a classified catalog of the engineers of America as it may be practicable to get together. Much information has been assembled, but a great deal remains to be collected. During war time lists collected by this committee and the engineering societies co-operating with it are being used to supply thousands of names in response to calls from government departments for specialists for combatant and other forces of the army and navy and for the war industries. This committee frequently could use volunteers not only in New York but in distant communities also in scouting for men to meet special and urgent calls from the government, as well as in other ways.

The war committee of technical societies is engaged upon the examination of new inventions offered to the War and Navy departments and to stimulation of the development of useful new appliances for warfare. In reviewing ideas received, preparing bulletins and writing reports and records, this committee could make use of a number of helpers from time to time.

The water conservation committee is organizing to deal with questions of policy in various parts of the country concerning the utilization and control of water for such purposes as power development, navigation, irrigation and municipal supply. This committee will need correspondents to aid it in keeping informed or in asking special investigations about local laws and policies.

Engineers who are able and willing to take some part in this service for the profession should communicate with Alfred D. Flinn, secretary of the Engineering Council, 29 West Thirty-ninth Street, New York.

DISCUSSION ON LICENSING ENGINEERS

At the regular meeting of the Engineering Council on June 20 a special report by the public affairs committee on the licensing of engineers was debated at length. It was decided to create a small special committee to study this important question thoroughly with a country-wide view. It is intended that through the work of this committee the Engineering Council shall in due time be prepared to advise engineering organizations in any of the states upon this much discussed matter. Engineers who have knowledge of proposed legislation are requested to communicate with the secretary of the Engineering Council. Information or rumor has already been received of possible action by the Legislatures of Iowa, Ohio, Indiana and Michigan. A few states have passed laws.

The fuel conservation committee has been working with the Fuel Administration and the Bureau of Mines, particularly in consultation on questions of policy.

A committee on Americanization activities was authorized for the purpose of co-operating with the National Americanization Committee and the Bureau of Education of the Department of the Interior. The council was requested by Miss Frances A. Kellor, special adviser to the Bureau of Education, to appoint such a committee to co-operate in the war-work extension in an advisory capacity, especially in educational propaganda among mechanics and laborers with whom engineers come in contact.

Upon receiving a telegram from Boston engineers that the Legislature of Massachusetts was expected to pass a bill abolishing the Public Service and the Gas and Electric Commissions and substituting a Public Utilities Board, the Engineering Council passed resolutions, in part as follows, which were sent to Governor McCall:

> Whereas experience has shown that engineering training, combined with special knowledge of organization and experience therein, is of great advantage to the public and should be associated with business capacity and tact for the efficient discharge of the duties of a public utilities board, be it therefore
>
> Resolved, that the Engineering Council suggests the advisability of the appointment to membership on your board of at least one engineer who is qualified by training and experience for such duties as may be required of the members of such a board.

The recent meeting completes the first year of the council's activities.

Possibilities with Higher Steam Pressures

With Steam at 800 Lb. Pressure and 800 Deg. Fahr., 1 Kw.-hr. Can Be Produced on 11,750 B.t.u.—Sufficient Superheat to Reduce the Condensation in the Turbine to a Practicable Minimum Is Found Advisable

BY ESKIL BERG
Engineer Turbine Department General Electric Company

IN DEVELOPING the steam turbine the designer has constantly had higher efficiency in view and in this respect has succeeded to the extent that to-day turbines are in operation having a thermodynamic efficiency of almost 90 per cent. While this already high efficiency may be improved by a small percentage in the future, it will be necessary to look to other parts of the power plant for substantial gains in fuel economy. Such gains can be made by increasing the temperature range of the steam, but as the lower range is fixed by the temperature of the cooling water, the gain must be made by going to a higher initial temperature. This can be accomplished by the use of higher steam pressure, by the application of superheat or by a combination of both.

The theoretical gain obtainable by the use of higher steam pressures is illustrated in Table II, in which case 1 lb. of dry steam at 200 lb. pressure (14.1 kg. per sq. cm.) expanded to 28½ in. (72.39 cm.) of vacuum is considered unity. It will be seen that by raising the boiler pressure to 500 lb. (35.15 kg.) there is a saving in fuel of 14.43 per cent. In money this saving would amount to about $200,000 a year in a plant burning about 900 tons a day with coal at $5 a ton.

Table III shows the theoretical gain by superheat. The table is calculated on the basis of an initial pressure of 250 lb. (17.6 kg.) gage expanded to a 29-in. (73.66 cm.) vacuum. It will be seen that the theoretical gain is small, being only 2.9 per cent when superheating up to 300 deg. To this, however, must be added the practical benefit of using superheat. This is often expressed by saying that the water rate is reduced 1 per cent for a certain number of degrees of superheat. The amount of this decrease varies with turbines of different design, but a figure frequently used is 1 per cent gain in water rate for every 12.5 deg. increase of superheat. Column 5, Table III, is based upon this assumption. The actual net gain of fuel in per cent is therefore shown by column 8, which is the difference between column 7 and column 4. The practical gain by superheat is about two and one-half times as great as the theoretical, the reason being that in a well-designed turbine of, say, the impulse type the magnitude of the total losses is about the following proportions when dry initial steam is used:

	Per Cent.
Loss due to friction in nozzles and blades and windage loss of disks and blades	20
Leakage loss	3
Rejected energy (due to residual steam velocity)	3
Bearings, packing, etc	1
Total losses	27
Efficiency of turbine	73

From the preceding table it may be seen that the first item is by far the most important, and it is this one that is reduced by the use of superheat. The use of 200 deg. superheat will reduce the friction and windage loss about one-quarter, or to 15 per cent, and the total loss would then be 22 per cent, making the turbine efficiency 78 per cent. This reduction is effected by the superheat reducing the moisture in all the stages. The reduction is best shown by entropy-temperature dia-

TABLE I—THEORETICAL WATER RATES PER KW.-HOUR
(Heat Values from Marks & Davis' Steam Tables)

Suphtd. Deg. F.	26 in.	27 in.	27.5 in.	28 in.	28.5 in.	29 in.
150 LB. GAUGE						
0	11.80	11.23	10.92	10.55	10.12	9.59
25	11.61	11.05	10.74	10.38	9.96	9.44
50	11.42	10.87	10.58	10.22	9.81	9.30
75	11.24	10.71	10.41	10.07	9.66	9.17
100	11.07	10.55	10.26	9.92	9.52	9.03
125	10.90	10.38	10.10	9.77	9.38	8.90
150	10.75	10.23	9.96	9.63	9.25	8.78
160 LB. GAUGE						
0	11.66	11.10	10.79	10.43	10.01	9.50
25	11.45	10.91	10.61	10.26	9.85	9.34
50	11.28	10.75	10.45	10.11	9.70	9.21
75	11.10	10.58	10.29	9.95	9.56	9.07
100	10.92	10.41	10.13	9.80	9.42	8.94
125	10.75	10.25	9.98	9.66	9.27	8.81
150	10.60	10.10	9.84	9.52	9.15	8.69
165 LB. GAUGE						
0	11.57	11.03	10.73	10.37	9.96	9.45
25	11.39	10.84	10.55	10.20	9.80	9.30
50	11.20	10.68	10.39	10.05	9.65	9.16
75	11.02	10.50	10.22	9.89	9.50	9.02
100	10.85	10.35	10.08	9.75	9.37	8.89
125	10.68	10.18	9.92	9.60	9.23	8.76
150	10.52	10.04	9.77	9.46	9.10	8.64
170 LB. GAUGE						
0	11.50	10.96	10.66	10.32	9.91	9.40
25	11.31	10.78	10.49	10.15	9.75	9.25
50	11.13	10.61	10.33	9.99	9.60	9.11
75	10.95	10.45	10.17	9.84	9.45	8.98
100	10.79	10.29	10.02	9.70	9.32	8.85
125	10.62	10.13	9.86	9.55	9.18	8.73
150	10.47	9.99	9.73	9.42	9.05	8.60
175 LB. GAUGE						
0	11.44	10.91	10.61	10.27	9.87	9.36
25	11.25	10.72	10.44	10.10	9.70	9.21
50	11.07	10.55	10.27	9.94	9.55	9.07
75	10.89	10.39	10.11	9.79	9.41	8.94
100	10.72	10.23	9.96	9.64	9.27	8.81
125	10.55	10.07	9.81	9.50	9.13	8.68
150	10.40	9.92	9.67	9.37	9.00	8.56
180 LB. GAUGE						
0	11.37	10.85	10.56	10.22	9.82	9.31
25	11.18	10.67	10.38	10.05	9.66	9.17
50	11.01	10.50	10.22	9.89	9.51	9.03
75	10.83	10.34	10.06	9.74	9.37	8.90
100	10.66	10.17	9.90	9.60	9.22	8.77
125	10.49	10.02	9.76	9.46	9.09	8.65
150	10.34	9.87	9.61	9.32	8.96	8.52
185 LB. GAUGE						
0	11.31	10.79	10.51	10.17	9.77	9.28
25	11.12	10.61	10.33	10.00	9.61	9.13
50	10.94	10.44	10.17	9.84	9.46	8.99
75	10.77	10.28	10.02	9.69	9.32	8.86
100	10.60	10.12	9.86	9.55	9.19	8.73
125	10.43	9.97	9.72	9.41	9.05	8.61
150	10.28	9.82	9.57	9.27	8.92	8.49
190 LB. GAUGE						
0	11.25	10.74	10.46	10.12	9.73	9.25
25	11.06	10.56	10.28	9.96	9.58	9.10
50	10.88	10.39	10.12	9.80	9.42	8.96
75	10.71	10.23	9.97	9.65	9.28	8.82
100	10.55	10.08	9.82	9.51	9.15	8.70
125	10.39	9.92	9.67	9.37	9.01	8.58
150	10.23	9.77	9.53	9.24	8.88	8.46
195 LB. GAUGE						
0	11.20	10.69	10.41	10.08	9.69	9.22
25	11.01	10.51	10.24	9.92	9.53	9.07
50	10.83	10.35	10.08	9.76	9.38	8.92
75	10.66	10.18	9.92	9.61	9.24	8.79
100	10.50	10.03	9.77	9.47	9.11	8.66
125	10.33	9.87	9.62	9.32	8.97	8.54
150	10.18	9.72	9.48	9.18	8.84	8.42
200	9.86	9.43	9.19	8.92	8.59	8.18
200 LB. GAUGE						
0	11.15	10.64	10.37	10.04	9.66	9.18
25	10.95	10.46	10.19	9.87	9.49	9.03
50	10.77	10.29	10.03	9.71	9.34	8.88
75	10.61	10.13	9.87	9.57	9.20	8.75
100	10.44	9.97	9.72	9.42	9.06	8.62
125	10.28	9.83	9.58	9.28	8.93	8.50
150	10.13	9.68	9.44	9.15	8.81	8.38
200	9.81	9.39	9.15	8.88	8.55	8.15
205 LB. GAUGE						
0	11.09	10.60	10.32	9.99	9.62	9.15
25	10.90	10.41	10.14	9.82	9.45	8.99
50	10.72	10.24	9.98	9.67	9.30	8.85
75	10.55	10.09	9.83	9.53	9.17	8.72
100	10.39	9.93	9.68	9.38	9.03	8.59
125	10.23	9.78	9.54	9.24	8.90	8.47
150	10.08	9.64	9.39	9.11	8.77	8.35
200	9.77	9.35	9.11	8.84	8.52	8.12
210 LB. GAUGE						
0	11.04	10.55	10.28	9.97	9.59	9.12
25	10.85	10.37	10.10	9.79	9.42	8.96
50	10.68	10.20	9.94	9.63	9.27	8.82
75	10.50	10.04	9.78	9.48	9.13	8.69
100	10.34	9.89	9.63	9.34	9.00	8.56
125	10.19	9.75	9.49	9.21	8.87	8.44
150	10.03	9.60	9.35	9.07	8.74	8.32
200	9.73	9.31	9.08	8.81	8.49	8.10
215 LB. GAUGE						
0	11.00	10.51	10.24	9.93	9.55	9.09
25	10.79	10.32	10.05	9.75	9.38	8.93
50	10.62	10.16	9.89	9.59	9.24	8.79
75	10.46	10.00	9.74	9.44	9.09	8.66
100	10.30	9.85	9.60	9.30	8.96	8.53
125	10.14	9.70	9.46	9.16	8.83	8.41
150	9.98	9.55	9.31	9.03	8.71	8.29
200	9.68	9.27	9.04	8.77	8.48	8.06
220 LB. GAUGE						
0	10.95	10.47	10.20	9.89	9.52	9.06
25	10.75	10.28	10.02	9.71	9.35	8.90
50	10.58	10.11	9.85	9.55	9.20	8.76
75	10.41	9.95	9.70	9.40	9.06	8.63
100	10.24	9.80	9.55	9.26	8.93	8.50
125	10.09	9.66	9.42	9.13	8.80	8.38
150	9.94	9.52	9.28	9.00	8.67	8.27
200	9.64	9.23	9.00	8.74	8.42	8.03
225 LB. GAUGE						
0	10.90	10.42	10.16	9.85	9.48	9.03
25	10.71	10.24	9.98	9.67	9.32	8.87
50	10.53	10.07	9.81	9.52	9.17	8.73
75	10.36	9.91	9.66	9.37	9.03	8.60
100	10.20	9.76	9.52	9.23	8.90	8.47
125	10.05	9.62	9.38	9.10	8.77	8.35
150	9.90	9.47	9.24	8.96	8.64	8.23
200	9.60	9.20	8.97	8.71	8.40	8.01
230 LB. GAUGE						
0	10.86	10.39	10.12	9.82	9.45	9.00
25	10.66	10.20	9.94	9.64	9.28	8.84
50	10.48	10.03	9.78	9.48	9.13	8.70
75	10.32	9.87	9.63	9.34	8.99	8.57
100	10.16	9.72	9.48	9.70	8.86	8.45
125	10.01	9.58	9.34	9.06	8.74	8.33
150	9.85	9.44	9.20	8.93	8.61	8.21
200	9.56	9.16	8.93	8.67	8.37	7.98
235 LB. GAUGE						
0	10.81	10.35	10.09	9.78	9.42	8.96
25	10.61	10.15	9.90	9.60	9.25	8.81
50	10.44	9.99	9.75	9.45	9.10	8.67
75	10.27	9.83	9.59	9.30	8.96	8.54
100	10.12	9.68	9.45	9.17	8.83	8.42
125	9.96	9.54	9.30	9.03	8.70	8.29
150	9.81	9.40	9.16	8.90	8.58	8.18
200	9.52	9.12	8.90	8.64	8.33	7.95
240 LB. GAUGE						
0	10.76	10.31	10.05	9.75	9.39	8.94
25	10.57	10.12	9.86	9.57	9.22	8.78
50	10.38	9.95	9.70	9.41	9.07	8.64
75	10.23	9.79	9.55	9.26	8.93	8.51
100	10.08	9.65	9.41	9.13	8.80	8.39
125	9.92	9.50	9.27	9.00	8.67	8.27
150	9.97	9.36	9.13	8.86	8.55	8.15
200	9.48	9.09	8.87	8.61	8.31	7.93
245 LB. GAUGE						
0	10.73	10.27	10.01	9.71	9.35	8.91
25	10.53	10.08	9.83	9.53	9.18	8.75
50	10.35	9.91	9.67	9.38	9.04	8.61
75	10.19	9.76	9.52	9.23	8.90	8.48
100	10.03	9.61	9.37	9.09	8.77	8.36
125	9.88	9.47	9.23	8.96	8.64	8.24
150	9.73	9.33	9.10	8.83	8.52	8.12
200	9.43	9.04	8.82	8.57	8.27	7.90
250 LB. GAUGE						
0	10.69	10.23	9.98	9.68	9.33	8.89
25	10.49	10.04	9.79	9.49	9.15	8.72
50	10.31	9.87	9.63	9.34	9.01	8.59
75	10.15	9.72	9.48	9.20	8.87	8.46
100	9.99	9.57	9.34	9.07	8.74	8.34
125	9.84	9.43	9.20	8.93	8.61	8.22
150	9.69	9.29	9.06	8.80	8.49	8.10
200	9.41	9.02	8.80	8.55	8.25	7.88

grams. From such a diagram it may be seen that starting with dry steam at 265 lb. (18.6 kg.) absolute pressure and expanding it adiabatically to 29 in. vacuum through a turbine of 100 per cent efficiency would result in steam of about 26.5 per cent moisture, whereas if the steam had been superheated to say 250 deg. this moisture would be reduced to about 19 per cent, a reduction of almost 30 per cent. In an actual tur-

TABLE II.—THEORETICAL GAIN IN FUEL BY INCREASING STEAM PRESSURE

Absolute Pressure, Lb.	Corresponding Temperature, Deg. Fahr.	Total Heat	Increase in Total Heat, Per Cent.	Available Energy in Ft.-Lb. Expanding to 28.5 in Vacuum	Increase of Available Energy, Per Cent.	Net Gain in Fuel, Per Cent
200	381.9	1198.5	....	272,000	.....	.....
300	417.5	1201.9	0.28	293,000	7.72	7.44
400	444.8	1202.5	0.33	304,500	11.95	11.62
500	467.2	1201.7	0.27	312,000	14.7	14.43
600	486.5	1199.8	0.11	319,000	17.2	17.09
700	503.4	1197.4	0.902	323,000	18.7	18.79
800	518.5	1194.4	—0.342	327,000	20.2	20.54
900	532.3	1191.1	—0.617	329,000	20.9	21.51
1000	545.0	1187.6	—0.909	331,000	21.7	22.6

bine this percentage of moisture is a great deal lower, the amount depending upon the efficiency.

Table IV gives a comparison of the condition of the steam in each stage of a ten-stage turbine using dry steam and using steam superheated to 250 deg. temperature. It is assumed that the turbine has 80 per cent efficiency, is supplied with steam at 250 lb. (17.6 kg.) pressure, and is exhausting into a 29-in. vacuum.

For determining the effect of moisture on friction a great many formulas and curves are given by various authors based upon experimental and theoretical data, and they all have a constant which varies according to the conditions of the steam. Professor Moyer, for example, in his book on steam turbines, gives a formula for rotation losses of buckets and wheel disks in which the constant is as follows:

	Constant
100 deg. superheat	0.875
50 deg. superheat	0.93
0 deg. superheat	1.00
5 per cent moisture	1.08
10 per cent moisture	1.25
20 per cent moisture	2.00

In other words, the friction loss is twice as great with 20 per cent moisture as it is with dry steam.

Throttling of dry steam always produces superheat, and it has often been said for this reason that there is practically no loss due to throttling, which is true as far as heat is concerned. There is, however, a considerable loss of available energy. The amount of superheat obtained by throttling is easily calculated because the total heat before and after throttling is the same. Assume that steam at 200 lb. (14.1 kg.) absolute pressure is throttled down to 100 lb. (7 kg.) absolute pressure. The total heat in dry steam at 200 lb. abs. = 1198.1 and that at 100 lb. abs. = 1186.3. If the specific heat of steam is taken as 0.5, then $1198.1 = 1186.3 + (0.5 \times t)$ in which t, the superheat, = 23.6 deg. The available energy, however, assuming that the steam in both cases is expanded to 28.5 in. vacuum, is, with 200 lb. pressure and dry steam, 270,800 ft.-lb. and, with 100-lb. pressure and 23.6 deg. superheat, 240,200 ft.-lb., or a loss in available energy of about 11 per cent.

High steam pressure with no superheat has the disadvantage, as may be seen from an entropy diagram, of producing more moisture through the turbine. It is therefore advisable to combine high pressure with superheat so as to produce a more efficient turbine.

With steam pressure of 200 lb. gage, 150 deg. superheat (temperature of 538 deg.) and a vacuum of 28.5 in., the present practice of turbine plants in this country, the ratio of maximum available heat for work to the total heat is only about 31.25 per cent. In Europe, however, steam temperatures as high as 700 deg. Fahr. are now used (corresponding to a steam pressure of 500 lb. and 233 deg. superheat), so the ratio of available heat is about 36.3 per cent there. This permits a fuel saving of 16 per cent compared with conditions in this country.

Turbine-generator sets are now built having an overall efficiency of more than 80 per cent, including generator losses, which with a boiler efficiency of 80 per cent would give an efficiency from fuel amounting to $36.3 \times 0.80 \times 0.80 = 23.26$ per cent. Since 1 kw.hr. = 3412 B.t.u., the B.t.u. required to produce 1 kw.-hr. at the switchboard = $3412 \div 0.2325 = 14{,}675$. On the other hand, if 800 lb. pressure and 800 deg. temperature are used, the efficiency will be 38.75 per cent; so that with a turbine efficiency of 85 per cent and a boiler efficiency of 88 per cent (obtainable with liquid fuel, forced draft and preheated combustion air) a kilowatt-hour could be obtained on $38.75 \times 0.88 \times 0.85 = 29$ per cent, or $3412 \div 0.29 = 11{,}750$ B.t.u. This is equivalent to $11{,}750 \div 19{,}000 = 0.62$ lb. of fuel oil per kilowatt-hour.

Diesel-engine advocates now claim about 0.55 lb. of fuel oil per kilowatt-hour, but this is obtained only with a fuel about 50 per cent higher in price than that which can be satisfactorily burned under a boiler. It may thus be seen that when full advantage has been taken of the various processes that are used in trans-

TABLE III.—EFFECT OF SUPERHEATING STEAM WHEN WORKING BETWEEN 250 LB. GAGE AND 29 IN. OF VACUUM

Degree Superheat	Temperature, Deg. Fahr.	Total Available Energy per Lb. of Steam	Total B.t.u. per Lb.	Per Cent. Increase in Coal to Produce Superheat	Per Cent. Increase Available Energy Due to Superheat	Net Theoretical Gain, Per Cent.	Actual Gain, Per Cent.	Actual Net Gain, Per Cent.
(1)		(2)	(3)	(4)	(5)	(6) = (5—4)	(7)	(8) = (7—4)
0	406	298,000	1202.3	....	....	....	....	....
50	456	308,500	1237.0	2.89	3.53	0.64	4.00	1.11
100	506	318,000	1264.6	5.18	6.72	1.54	8.00	2.82
150	556	327,500	1290.5	7.33	9.90	2.57	12.00	4.67
200	606	336,000	1315.6	9.45	12.75	3.30	16.00	6.55
250	656	341,500	1340.5	11.50	14.60	3.10	20.00	8.50
300	706	347,000	1365.3	13.55	16.45	2.90	24.00	10.45

forming the energy of the fuel into mechanical energy through the medium of steam the steam process compares quite favorably with results obtained at the present time with internal-combustion engines.

In a discussion of this subject which took place at a joint meeting of the Western Society of Engineers and the Chicago sections of the American Society of Mechanical Engineers and American Institute of Electrical

Engineers lately questions arose as to the practicability of obtaining piping and equipment that will withstand higher pressures and superheats, whether the increased cost of the equipment will keep pace with the gain in economy, the probability of higher radiation losses, the possibility of superheat high enough to give dry steam at the turbine exhaust, the possible advantages of re-superheating the steam for the lower stages with the waste heat from the boilers, and the interference of economizers in obtaining the theoretical advantages from higher pressures and superheat.

To show that the design of equipment for the higher pressures mentioned is not impracticable the author referred to the case of De Laval, in 1817, supplying all the electrical energy for lighting the Exposition of Arts and Industries in Stockholm with turbo-generating sets operated from boilers of his own design using over 1500

TABLE IV.—QUALITY OF STEAM IN TEN STAGES OF A TURBINE, STARTING WITH DRY STEAM SUPERHEATED 250 DEG.

	Stages									
Quality of Steam	1	2	3	4	5	6	7	8	9	10
Dry initial, per cent. moisture	4.4	6.8	8.15	9.8	11.5	13	14.5	16.0	17.3	18.7
250 Deg. Superheat:										
Deg. superheat	160.0	120.0	75.0	30.0	....	....	....	....	....	....
Per cent. moisture	....	....	....	....	0.6	2	4.0	6.5	8.0	10.5

lb. pressure. Of course the units were small, four being rated at 100 hp. and two at 50 hp. each.

To get dry steam at the exhaust in the average turbine would require excessive superheat. Enough superheat to reduce the moisture to 5 or 6 per cent at the turbine exhaust is about the practical limit.

The author holds that the cost of high-pressure equipment will be less than that of present equipment. This applies particularly to the boiler. Smaller tubes can be used, say of 1-in. (2.54-cm.) diameter, and the boiler can be smaller, lighter and cheaper than boilers carrying the lower pressures of to-day. All auxiliaries would have to be redesigned, and it would probably be best to eliminate joints and weld the piping system solid.

There would be a little more moisture from condensation at the casing. The use of the flue gases for re-superheating the steam for the lower stages would necessitate splitting the turbine into two elements, so that the residual velocity would be lost, causing a drop of 5 or 6 per cent in efficiency. It would also introduce undesirable complications. However, there might be a gain in using an oil-fired superheater for the purpose, allowing the gases to pass into the boiler.

Electricity for Rural Districts in Sweden

United States Consul Wallace J. Young, stationed at Gothenburg, Sweden, reports that owing to the scarcity of fuel and illuminating oils the possibility of further utilizing Sweden's hydroelectric power is receiving serious attention. In many rural districts electric power and lighting are already in use, and this use is constantly increasing despite the difficulty of obtaining copper for the transmission lines. Recently there was a meeting of representatives of several associations for the distribution of electrical energy and delegates from farmers' credit funds, at which it was resolved to invite all the Swedish rural societies of this character to organize a central association.

COMING APPROPRIATIONS FOR THE PANAMA CANAL

Estimates for the Next Fiscal Year Call for a Total Expenditure of $1,731,129.54 on Electrical Equipment and Labor

Estimates of appropriations for expenditures on electrical labor and electrical supplies and equipment for the maintenance and operation of the Panama Canal and for use in the Panama Canal Zone for the fiscal year ending June 30, 1919, amount to $1,731,129.54, which is divided as follows:

PANAMA CANAL MAINTENANCE AND OPERATION		
Wages and salaries, electrical division		$590,000
Maintenance of equipment:		
Generating equipment		241,000
Electric lighting equipment		136,500
Electrician supplies (not otherwise stated)		55,900
Wire and cable		103,265
Wire covered and coated		108,925
NEW PROJECTS, ELECTRICAL DIVISION		
One 4500-kw. generator for hydroelectric station at Gatun		125,000
Two 66,000-volt transmission feeders, with equipment (hydroelectric station to Gatun substation)		50,000
One 8400-kva. transformer (Gatun substation)		40,000
One 5000-kva. synchronous condenser (Balboa substation)		60,000
Four 2200-volt distribution feeders, substation equipment		12,000
Auxiliary hook for hydroelectric crane		2,000
Miscellaneous additions and alterations to plant not chargeable to the cost of power		25,907
30-ton traveling chain hoist (Gatun substation)		5,000
Belt-driven governors for hydroelectric units Nos. 1, 2 and 3		3,500
Underground cables and extensions to duct system:		
Mindi cable	$12,000	
Extension to New Cristobal	20,000	
Cable to Corozal	4,000	
Cristobal (rearrangement)	13,000	
Cable to New Culebra	15,000	
Feeder to Ancor Hospital	20,000	
Total		84,000
Changes from overhead to underground distribution:		
Ancon-Balboa	$15,000	
Pedro Miguel	3,000	
Gatun	2,000	
Cristobal	8,000	
Total		28,000
Extensions to street-lighting systems:		
Corozal	$3,850	
Colon Beach and hospital	11,000	
Paraiso	7,500	
Red Tank	5,000	
Total		27,350
CANAL ZONE SANITATION		
Electric power, repairs and installations, electric division		6,000
CANAL AND CANAL ZONE CIVIL GOVERNMENT		
Electric energy and repairs, electric division		75.00
Postal service		900.00
Electric signaling and lighting equipment for police launches		125.00
Electric fire-alarm system		4,000.00
PANAMA CANAL FORTIFICATIONS		
Manufacture and test of ammunition, heating, lighting and electric materials		3,705.44
Artillery, electric supplies		785.15
Submarine mines, electric supplies		2,691.95
Fire control, submarine cable and reels		2,500.00
Aerial and underground cable		1,500.00
Power equipment (including generators, storage batteries, switchboard, etc.)		500.00
Construction and other material, including wire, poles, dry cells, etc		5,000.00
District signal stations, including all radio and visual signaling equipment		5,000.00
Grand total		$1,731,129.54

In addition is the electrical work on some army cantonments, one (contract let) to cost $1,663,628 and the other to cost $290,932.

The Engineering Profession in Warfare

How American Engineers Have Responded to the Call of the Nation—Military Needs That Have Been Met—Engineering Plays an Important Part from the Front of the Army to the Rear

BY GEN. WILLIAM M. BLACK
Chief of Engineers United States Army

Following is part of the address made by General Black before the Atlantic City convention of the American Institute of Electrical Engineers on June 27. While recognizing the great services of engineers in the war, General Black also made some constructive criticisms in advocacy of the broadest possible education of men preparing to enter the engineering professions.

ENGINEERING in warfare has always been essential, and it is even doubtful whether the science of engineering does not owe its birth to the works of war. An engineer myself, I would be the last to belittle the work of our profession. It is a matter of pride that the men of our profession, because of the nature of their employment in time of peace, are, of all the civil professions, most prepared to serve the country in war; but to serve the country adequately in war the engineer must add to his peace equipment for professional work. There would be a great amount of effort saved if our people recognized more clearly the existence of the technicalities of the profession of arms. The government in Washington is simply deluged with suggestions and so-called inventions for the winning of the war. The records show that about ninety-eight per cent of all these are without military value and that time and labor have been thrown away by men eager to help but entirely ignorant of the history and conditions of warfare.

THE PART THAT ENGINEERS ARE TAKING

The part which engineers are now playing in the war is a very great one. The records of the American Institute of Electrical Engineers show that out of a total membership of 9370 there are 850 in the service, or 9.1 per cent of its roster. The American Society of Civil Engineers, with 8573 active members, has 14⅓ per cent in the service. The American Institute of Mining Engineers has 10.4 per cent, and the American Society of Mechanical Engineers 10.1 per cent. But these records are not complete. At the outbreak of the present war there were in the Engineer Corps of the regular army about 300 officers and approximately 3500 enlisted men. At the present time there are about 8000 commissioned officers and 200,000 enlisted men, made up of men formerly engaged in works of an engineering character. It is probable that this does not represent much more than one-half of the number of the profession now serving in the army.

Let us consider the nature of the work of the engineer, passing from front to rear of the army. First in importance is the work of the sappers. They go before and remove obstacles, clearing away obstructions, building bridges and roads, making the trench systems complete, mining, providing light, water, lines for supply (light railways or roads) and military mapping. In this category enter practically all of the branches of the profession. Further to the rear are found the construction and operation of railways; road and bridge construction; the construction of veritable towns for supply depots, with all their accessories, drainage, sewerage, lighting and water supply; construction of quarters and of hospitals; and furthest to the rear; the construction of the ports of debarkation with their wharves, storehouses, railway lines, yards and shops, all with their sanitary systems. Separate from these activities, but necessary for their supply, are the forestry troops who turn the growing timber into lumber of the dimensions required for the various services. Locomotive and car-shop also are performing essential services. Topographic corps, sound-ranging corps and camouflage corps are also among the varied activities of the engineers.

What preparation is required for the fulfillment of these varied duties? For the actual technical work of construction or installation the civil training of the engineer should prove sufficient where the plans which embody the military features have been prepared or when the military technique has been learned and assimilated. A fundamental of this military technique is that the time element is to be considered rather than money cost and that the work must be done with whatever materials are available.

What have the engineers done? War was declared April 4, 1917. By the middle of July nine regiments of railroad engineers had been raised and organized and two had actually started for France. In each regiment were two officers of the Corps of Engineers of the regular army, the colonel and the regimental adjutant. The remaining officers were all from the Engineer Reserve Corps, some receiving their commissions only when on the point of sailing. Of course, few of the officers had had any previous military training and the tasks of organization were most difficult. Since then there have been organized five corps regiments, consisting of sapper, searchlight and sound-ranging troops; forty-three regiments and trains; two mounted battalions and trains; five pontoon trains; four inland-waterway companies; forty railway regiments and battalions, including all classes of standard gage and light railway troops necessary for the construction, operation and maintenance of railways; one railway transportation corps; one highway regiment; one gas and flame regiment; one gas training service; five forestry and auxiliary forestry regiments; one surveying and printing battalion; one military mapping service; two supply and shop regiments; one water-supply regiment; one quarry regiment; one mining regiment; one electrical and mechanical regiment; two crane-operating companies; one camouflage battalion; eighteen truck and auto companies, and forty-four depot detachments. The greater part of these organizations are now overseas. Some are serving with the British army, some with the French, but the majority are with our own troops, in service both at the front and in the rear.

Features of Industrial Motor Control

Important Functions of Controllers in Modern Plant Equipment—Apparatus for Use With Small Motors Should Fulfill Requirements Without the Necessity of Much Attention

BY C. E. CLEWELL
Assistant Professor of Electrical Engineering, University of Pennsylvania

ALTHOUGH the control equipment for industrial motors is commonly looked upon as a means for starting and stopping machinery or adjusting its speed, a more general view indicates that it often has to care for many other operating functions. For example, the controller may have to insure safety to machine-tool operators, afford a convenient method of remotely controlling the driving mechanism, permit automatic disconnection of the motor in case the supply voltage fails, or limit the amount of load which can be thrown onto a motor.

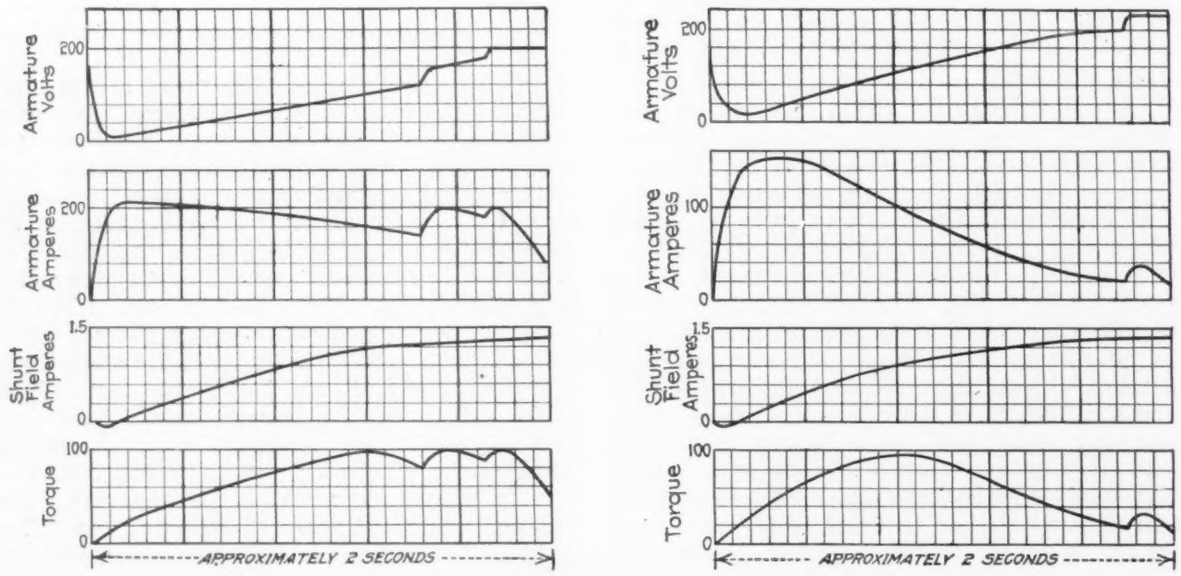
Starting Characteristics

In general, the selection of the control for small motors does not receive the same degree of attention nor is it likely to receive so much care in every-day operation as would be expected in connection with larger motors and control apparatus. However, the starting characteristics of small motors deserve a sufficiently close study so that they and their starting equipment shall not be overlooked in favor of the larger units.

One of the most interesting studies in connection with the starting of motors up to 15 hp. and 20 hp. was reported recently by H. D. James.[1] Certain references are made here to that report. Mr. James points to the fact that in the earlier days of the direct-current motor much care was necessarily taken in starting motors and also in changing their speed in order to prevent bad sparking or flashing. For the purpose, therefore, of keeping the current change small per step of the controller, a fairly large number of steps were employed for the starting rheostat. The adoption of the common face-plate starter followed, which, from the mechanical standpoint, can readily be arranged for a large number of starting steps. Many starting steps are required because of the tendency of such starters to arc and burn at the contact points if the current change per step is unduly large.

Changed Conditions Due to Improvements

Marked improvements both in motors and in controllers have changed some of the older limitations. As Mr. James points out in his report, the permissible starting currents for modern motors are not so likely to be limited by the effect they have on supply voltages as formerly, since small and even medium-sized motors can be started with twice full-load current or more without disturbing the supply voltage to any extent. However, there are applications where the starting current must be more carefully considered, as in the operation of elevator motors, certain power devices in public buildings, and especially printing presses and paper-making machines, where a relatively slow start is required and consequently a more unusual controller.



FIGS. 1 AND 2—OSCILLOGRAPH CURVES FOR A 20-HP., 230-VOLT SHUNT-WOUND DIRECT-CURRENT MOTOR WITH A "TWO-STEP" STARTING RESISTANCE, AND SIMILAR CURVES FOR THE SAME MOTOR BUT WITH A "ONE-STEP" STARTING RESISTANCE (JAMES)

The report mentioned before refers to the present successful operation of direct-current series and compound motors up to 20 hp. without the use of any external resistance for starting, and of shunt motors up to 15 hp. connected through drum controllers arranged to short-circuit the starting resistance in one step. Numerous oscillograph curves are given, among which those shown in Figs. 1 and 2 give the torque, field and armature current and armature volts of a 20-hp. shunt

[1] *Transactions A. I. E. E.*, Vol. 36, p. 253.

direct-current motor under starting conditions with a two-step and with a one-step controller respectively.

A comparison of Fig. 1 with Fig. 2 shows a somewhat higher current inrush with the one-step device, although it is not excessively greater. The higher value in Fig. 2 is undoubtedly due in large measure to the use of a 1-ohm starting resistance, whereas the starting resistance in Fig. 1 was 1.35 ohms. The tests on which

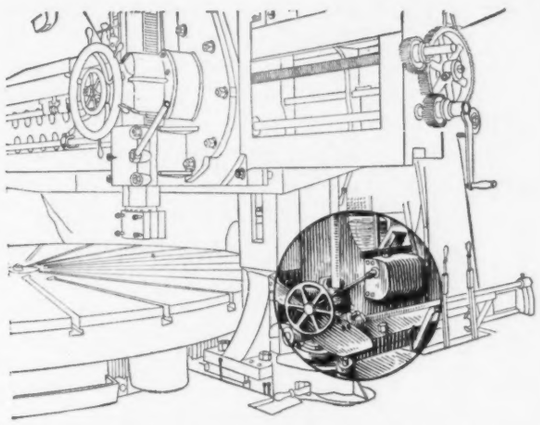


FIG. 3—BORING MILL OPERATED BY ONE 50-HP. AND TWO 15-HP. MOTORS

Note the controller with the extension handle and hand wheel.

the curves of Figs. 1 and 2 and numerous others were based have led to several conclusions which bear closely upon the control problem for motors of the smaller power sizes, and which may be outlined as follows:

1. With automatic acceleration it seems practicable to short-circuit the external armature resistance in one step for small motors except in certain special cases, this statement applying to sizes up to 15 hp.[2]

2. With a small or a zero value of the motor field at the start, the starting torque at the instant the switch is closed is also zero or a very small value, and it increases gradually, as indicated in Figs. 1 and 2, so that the motor and its load are not subject to undue mechanical stress as the lost motion is taken up.

3. The shunt field of small adjustable-speed motors may be reduced in one-step under normal load conditions, without a likelihood of excessive torque or current, for motors up to 50 hp. (Mr. James points out that practically all machine tools are started light, and since under this condition successful starting can be accomplished with the minimum strength of field, the field relay may be omitted. Thus it is possible to use the same controller for constant-speed and adjustable-speed motors, the latter merely being supplied with a separate field rheostat.)

4. The adjustable-speed motor may be dynamically braked with one step of resistance since the change in field strength tends to maintain a constant braking current over quite a range of speed.

5. The use of a fluttering relay is not advocated for hand-operated field rheostats unless a transfer relay is also employed for reversing its action when the motor regenerates.

6. The time required to accelerate to 95 per cent of normal speed did not exceed three seconds in the given tests and hence involves very short time intervals.

[2]These points are derived from Mr. James' paper previously referred to, and while some of the conclusions have been the subject of adverse criticism, they are recorded here for the consideration of the reader.

OTHER VIEWS

The six points enumerated refer to a limited series of tests, but the opinions expressed are based on a wide experience in the controller field. The discussion which resulted from the paper referred to was in some cases adverse, but in the main the general conclusion at which one is forced to arrive is that the principles enumerated by Mr. James on a basis of these tests are verified to a considerable extent by the performance of numerous installations. In one case exception is taken to the statement that machine tools practically always start light, since even where this may be the general rule nearly every motor and control installation is subject at certain times to starting conditions under load. Other cases occur where the motor must always start under load, the reciprocating pump being cited as an example. Obviously, counter-emf. contactor-switch controllers set for proper starting under light load will permit a larger peak of current than is indicated in the curves of Figs. 1 and 2[3], if subjected to full-torque starting, so readjustment is necessary under the latter condition.

In the cases of punches, presses, shears and most wood-working machinery and other high-speed motor drives R. G. Widdows points out that three acceleration contactors are usually required up to sizes of 15 hp., 220 volts, four from 20 hp. to 30 hp. and five for larger motors. In commenting on the use of one step of dynamic braking resistance for adjustable-speed motors he calls attention to the fact that the armature current during dynamic braking will remain fairly constant if the armature slows down at about the same rate

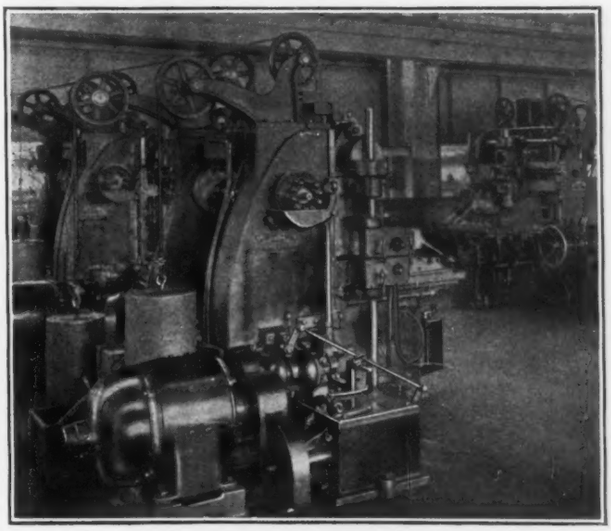


FIG. 4—A GROUP OF MILLING MACHINES EACH DRIVEN BY A 10-HP., 700-R.P.M. MOTOR

Note the location of the controller for the machine to the left, also clearance above the machine tools.

as the field flux increases. It follows, of course, that if the field flux increases more rapidly than the armature speed falls off peaks will result in the dynamic braking current.

Finally, the same author points to the slower acceler-

[3]From discussion of C. T. Evans, *Transactions A. I. E. E.*, Vol. 36, p. 300.

ation resulting from the elimination of the field relay (see the third conclusion above based on the paper by H. D. James) as a handicap on production. This point is well taken, since the one great feature of motor drive is that of increasing production in every possible way. Hence, to the extent that curtailed acceleration affects production adversely, the omission of a field relay can hardly be looked upon as an advantage despite the tendency which such a step has to simplify the controller equipment for joint constant-speed and adjustable-speed motor uses. Nevertheless, every step which leads to greater simplicity in controller design should be looked upon as a step forward in the economical development of industrial motor applications.

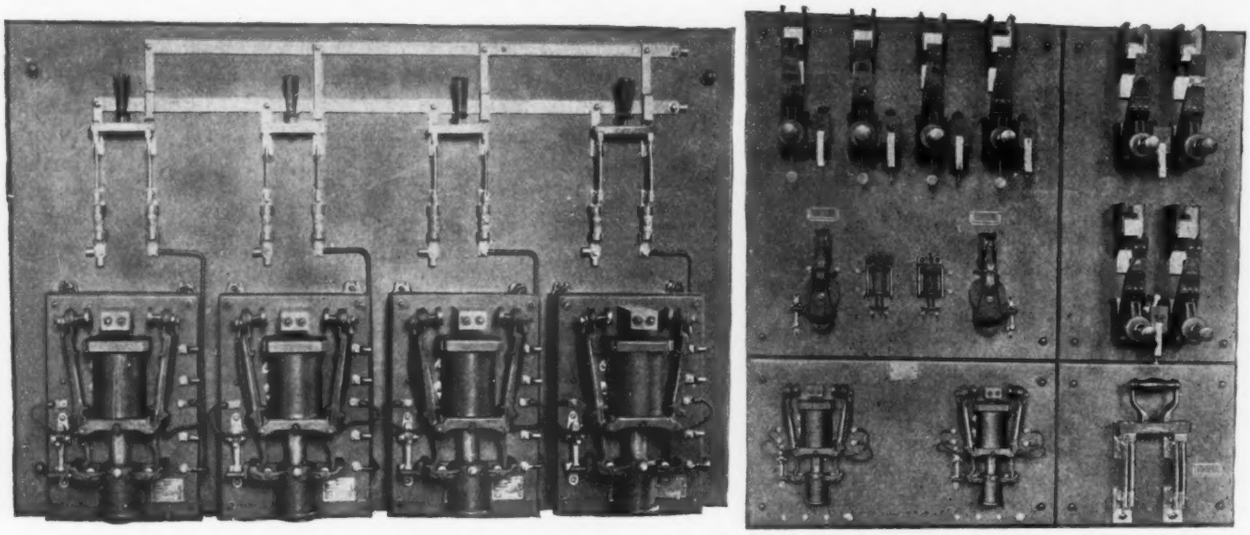


FIG. 5—CONTROLLER PANELS USED IN A BAKING FACTORY

VALUABLE POINTS OF REMOTE CONTROL

Remote control possesses some unusually important aspects from the practical operating standpoint. For example, motor-driven emery wheels are sometimes controlled through the medium of a platform in front of the wheel. This actuates a contact that permits automatic acceleration of the motor by magnetic contactor switches only at such times as the operator is standing on the platform. When he leaves the platform the motor is de-energized, thus preventing waste of energy.

Convenience for machine-tool operators is one of the most common and yet one of the most important reasons for placing control apparatus or handles at points near the normal position of work. The extension handle and hand wheel shown in Fig. 3 is an example of remote control applied to a large boring mill. Fig. 4 also brings out the fundamental advantage of the flexibility of arrangement with electric apparatus. In this latter case, the controller of the one milling machine to the left is shown at a convenient point in front of the machine tool, while the motor is out of the operator's way in the rear and to one side of the machine.[4]

Another good example of remote control is the use of float switches for the control of small motor-driven pumps, the pump being started and stopped by the switch at such times as to keep the water at certain prescribed limits of level—this operation being entirely automatic. These switches are made both for outdoor and indoor service.

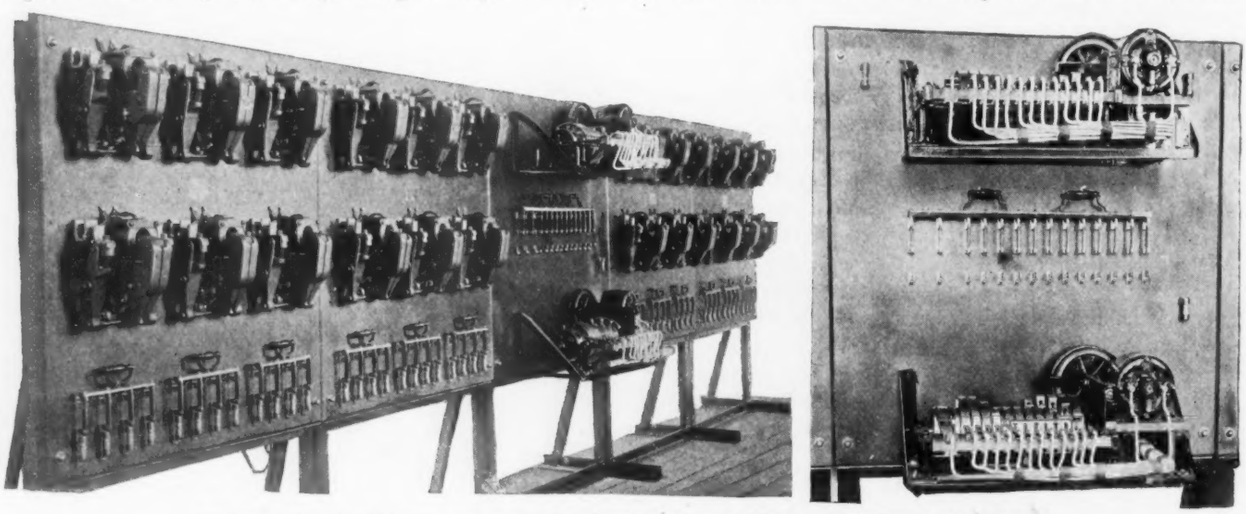


FIG. 6—CONTROL BOARDS USED FOR THE AUTOMATIC OPERATION OF LAUNDRY MACHINERY

[4]Figs. 1 and 2 are due to H. D. James, *Transactions A. I. E. E.*, Vol. 36, p. 257; Figs. 3 and 4 to the General Electric Company, and Figs. 5, 6 and 7 to the Sundh Electric Company.

When used for alternating-current motors float switches may throw the motor directly on to the supply mains, and if used for direct-current motors they may be used to throw in a regular self-starter in the usual way. In other words, float switches may be looked upon as falling under the head of master switches. It is also possible, of course, to operate motors used for such general purposes by a push-button, knife switch, snap switch or by pressure-gage switch when the compressor or pump empties into a closed-pressure system.

CONTROL-PANEL DESIGNS

Considerable attention has been given to the plans for control-panel equipment both as regards the convenience of hand-operated switches or other devices and the general appearance of the complete outfits. Many good examples of control-panel practice might be included, but it is the purpose to include illustrations of this nature in connection with some of the final articles of this series as applied to specific installations of motor drive. The present examples are limited to several cases of control panels in a number of industries.

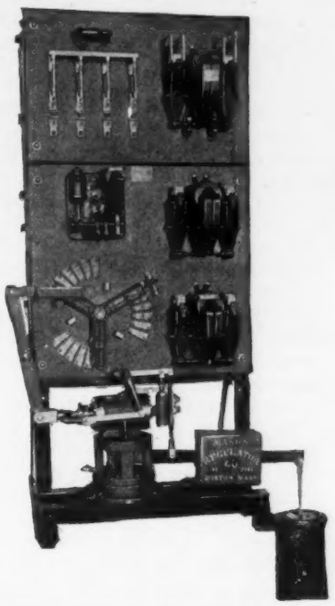


FIG. 7—AUTOMATIC STARTER WITH REGULATOR FOR VARYING AIR OR WATER SUPPLY IN BOILER-FEED OPERATION

As Mr. James aptly points out, the application of a controller calls for an analysis of the load to which the motor is to be connected and an equally careful analysis of the operating characteristics of the motor itself. The controller must, in brief, take the motor successfully through a duty cycle which is essential for the best operation of the driven machinery, and the application engineer can thus well afford to keep constantly in mind that the combined motor and its control, as a unit, is to perform a definite function in the industrial routine. Two things stand out, therefore, as of underlying importance in accompishing the desired results. One is to plan the installation with as small an amount of apparatus as possible, and the other is to select equipment which will produce satisfactory results while requiring the least attention.

PUSHING THE ELECTRIC VEHICLE IN CHICAGO

At the N. E. L. A. Electric Vehicle Section Meeting in That City Opportune Conditions Are Pointed Out

D. E. Whipple of the Anderson Electric Car Company entertained the Electric Vehicle Section of the National Electric Light Association at a luncheon at the sales rooms of the company in Chicago recently. At a "get together" meeting problems connected with the electric vehicle were discussed.

Probable shortage of gasoline and possible prohibition of its use in pleasure cars make this an especially opportune time to push the sale of electric passenger cars and trucks. A number of persons who have had chauffeur-driven gasoline cars are either selling them or laying them up during the war and buying electric vehicles. The Anderson Electric Car Company took in forty or forty-five gasoline cars in trade for electric cars in one month.

The scarcity and inefficiency of the men looking for work in electric garages has led a number of garage owners to try women and boys for various positions. One who tried women for cleaning cars says that for the first time the cars are really clean and that he has received no complaints regarding dirty cars since the women have been employed. Another owner is trying youths of about eighteen years as "hikers," with apparent success. Others suggested the training of women for this work, although their employment late at night might not be successful.

I AM sure that every one of us, every member company, and I may indeed say the whole industry, will stand solidly behind the government in this emergency and will render every possible assistance and co-operation in the stupendous task before us of winning the war. As utility companies which enjoy local franchises and esteem the good will of the public, we are sure we have not failed to recognize in many ways our duty to our local communities. Now, as deeply concerned participants in the country's welfare and prosperity, a further and supreme duty devolves upon us and is emphasized at this time—our duty to the nation. We did not seek this war; it was thrust upon us, and to have refused the gage of battle when our national honor was at stake would have been unthinkable cowardice. Now that we are in it, we must see it through and stay in to the finish, for the war must not end until it is won, and we must win it!—*John W. Lieb, in his presidential address before the National Electric Light Association.*

Central-Station Accounting in War Time

William Schmidt, Jr., Shows that the Accountant Must Promote Maximum Economy and Efficiency in All Directions

In this paper, presented before the recent National Electric Light Association convention at Atlantic City, Mr. Schmidt, secretary and assistant treasurer Consolidated Gas, Electric Light & Power Company, Baltimore, made specific suggestions for war-time economies.

IN SPEAKING of the changes which war has brought to the N. E. L. A. accountant, Mr. Schmidt said that this company official "now finds that he is a soldier—a strategist—that his utility has taken up definite functions in the war program, that he must marshal his personnel to fit in with the great army of American manhood and womanhood that is working to win the war; that he must determine the essentials and non-essentials of his work; with military precision guide his forces into lines of endeavor that will count most toward the accomplishment of the great cause; that he must serve his company and through it his government by taking account of all facts, factors and tendencies that promote the maximum of economy, of efficiency and of both operating and financial stability of the industry as a war unit."

Progress in Accounting Efficiency

Taking up the specific subject of accounting efficiency, Mr. Schmidt referred to the work of some companies in this direction. It includes the elimination of cumbersome accounting methods and dispensing with non-essential reports and statements; establishing consolidations of accounts for the sake of simplification of work; eliminating numerous distributions of expenditures to an unnecessary aggregation of accounts; installing modern labor-saving accounting machinery; substituting standardized forms and cheaper grades of paper, cheaper binders and other stationery, and employing women throughout the accounting organization.

Mr. Schmidt is convinced that a great deal more could be accomplished along the lines of accounting efficiency. He also suggested that all central-station operating managers consider the introduction of an engineering efficiency department, saying that the time of the operating heads is usually occupied with routine business, leaving no time available for consideration of improvements leading to economies in operation.

One way to make economies in the accounting organization, said Mr. Schmidt, is for the chief executives to appoint a committee, consisting of himself as chairman and the other principal officers of the company. Have the committee instruct the various department heads to send to the chairman's office a statement showing the nature of work of each clerical employee; copies of the reports and statements; names of those to whom these are sent and the reason why they are sent to each recipient; also recommendations from the department head as to the necessity for continuing the work performed by the various clerical employees and for continuation of the statements and other suggestions.

Many questions can be raised in this way. Some of those mentioned by Mr. Schmidt are: Has the statement served its purpose and could it be dispensed with? Is it necessary to have it typewritten? If only a second copy is required, why not use an indelible pencil or a stylographic pen and insert a sheet of carbon for the second copy? Could a cheaper grade of paper be used? Is the statement or clerical operation being duplicated in some other department?

Mr. Schmidt declared that in some of the best-managed companies where this plan has been tried from 25 to 50 per cent of the expense in operating a department has been eliminated.

A number of short cuts were mentioned by Mr. Schmidt, in brief as follows:

One company in accounting for freight, expressage and drayage charges the amount of the bill to an account known as "Freight, expressage and drayage" instead of adding the cost of the freight, expressage or drayage to the unit cost of the material, and credits the account with all cash discounts allowed for prompt payment of bills, instead of taking the cash discount from the unit cost of the material. This saves thousands of calculations.

Another company, instead of adding the percentage of storeroom expense to each store order or requisition, adds the expense at the end of the month to the amount charged to each account that is charged with material issued during the month. The same company adds all overhead expense to the cost of jobs completed instead of adding the overhead monthly as is done in many companies.

Another company handling job order cost accounting posts the labor costs at the end of each pay period, whereas in many companies the labor costs are posted daily from each time ticket. The same company, instead of itemizing on the cost sheet the various kinds of material used, simply inserts a copy of the store order in an envelope bearing the job order number, and when the job is completed the amount of material used is listed on the cost sheet.

In handling customers' accounts a number of companies transfer the meter indexes and the consumption from meter readers' books to the billing sheet and from the billing sheet to the ledger. One company makes this a direct operation by posting the meter readings and the consumption to the bill and posts only the amount of the bill to the ledger. As a war measure the same company is now considering eliminating the meter indexes from consumers' bills.

One company is considering condensation of the classification of accounts.

Time in issuing checks is saved by one company through the adoption of two series of checks, one for payments up to and including $100, which require only one signature.

Clerical work on purchase orders is saved by one company by the adoption of a plan whereby all material up to and including $15 cost can be ordered in emergency by departments from local dealers without authority from the purchasing department. One company eliminates entry work in the cash disbursement book, omitting the name of the payee. Another company saves time in passing invoices for payment and taking advantage of all cash discounts by discontinuing the sending of invoices to several departments for approval.

So far as Mr. Schmidt is aware, only one company has changed from monthly to bi-monthly billings. A number of other companies came to the conclusion that the savings effected through decrease in the number of clerks and meter readers would be largely offset by the increase in worthless bills, the increase in customers' complaints and the interest on the additional working capital required.

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

SERVICE INSTALLATION COMPLETED BY ONE CREW

Labor Costs Under Plan Used in St. Joseph Mo., Amount to $1.11 per Service, Including Maintenance Charge on Automobile

Handling all of the operations that go to make a customer's service installation complete in one job through the use of a single crew saves the St. Joseph (Mo.) Railway, Light & Power Company considerable money. Estimates made by the distribution department place this saving at $2 per service.

The crew, consisting of one foreman, two linemen, one groundman and one meterman, is able to string No. 6 B. & S. gage service wire to the consumer's premises, install the meter and connect the line so that energy is available in about one-half hour. The average cost of labor, including a charge of 30 cents per hour for maintenance of the crew's automobile, amounts to $1.11. The best record which such a crew ever made for installation of services in one day is sixty-five. Another advantage of this arrangement is the psychological effect upon the customer who sees the work completed by one set of men instead of by several crews with a long lapse of time between operations.

ELIMINATING OBJECTIONS TO EMPLOYEE BONUS SYSTEM

Western Plant Following This Plan Is Producing 1 Kw.-hr. with Every 2.9 Lb. of Fuel, Though Firing with Lignite Coal

One of the objections commonly raised by engineers who do not wish to establish a bonus system in the boiler room is that it tends to encourage dishonesty by the firemen. They contend that under such a system the men must be trusted to weigh coal and report all readings and that there is a tendency on their part to "juggle" the figures so that the bonus will be secured regardless of the real economy obtained.

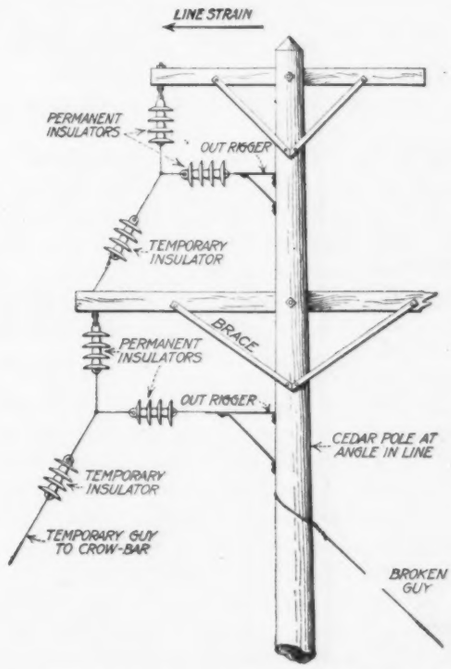
However, if the bonus is based on the weight of coal at the mine and on the kilowatt-hours delivered to the switchboard, this objection is obviated, according to a company in the West which operates an 11,700-hp. boiler room.

The men in this plant are provided with everything needed to assist in operating it efficiently. A permanent steam leak is a thing unknown. As soon as it appears a man is on the job fixing it, because in every free steam jet he sees his bonus escaping. Although the plant burns lignite, it has been possible since this system was installed to get an average economy of about 2.9 lb. of fuel per kilowatt-hour. It also keeps the men interested in the operation of the plant and creates a better feeling.

TEMPORARY REPAIR JOB ON POLE-LINE CORNER

Line Crew Effects Quick Repairs to Restore Service on High-Tension Line by Attaching Guys to Conductors

Finding the guy wire on one of its transmission-line corners broken and the line thereby grounded against the pole late one afternoon, a company in the Middle West was compelled to remedy the trouble quickly. The corners on this line are supported with strain insulators arranged at right angles, as shown in the accompanying



TEMPORARY GUY WIRES ATTACHED TO CONDUCTORS HELD INSULATORS IN PROPER POSITION

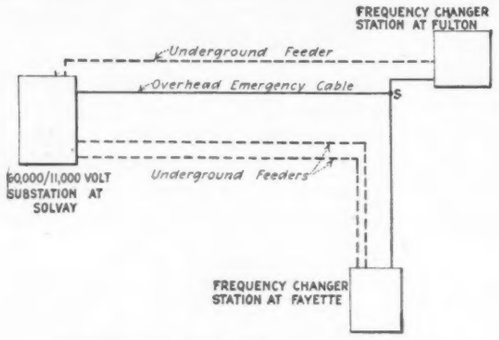
illustration. In order to effect hasty temporary repairs temporary guy wires were installed with necessary insulators to obtain the needed right-angle position of the permanent insulators.

The top lead was easily repaired by attaching its guy to the end of the second cross-arm. The lower lead—which had given the trouble—was repaired by attaching the end of the guy wire to a crowbar driven into the frozen earth of a nearby field. This eliminated the necessity, for the time being, of righting the pole to its vertical position, which was impossible in the time available before darkness set in. In this way a serious interruption to service was prevented pending the completion of permanent repairs. The simplicity of the method and the workmanlike results obtained should recommend it to repair crews.

EMERGENCY FEEDER IS UTILIZED AS TIE LINE

Arranged so That It Can Be Quickly Changed Over for Original Purpose if Trouble Occurs on Main Lines

In using energy generated at Niagara Falls, the Rochester (N. Y.) Railway & Light Company is required to change the frequency from 25 cycles to 60 cycles. This is done at two distribution stations, designated as the Fayette and Fulton respectively, the relative positions of which are shown in the accompanying illustration. The first is connected with the Solvay substation, where Niagara energy is stepped down from 60,000 volts to 11,000 volts by two underground cables, and the Fulton station receives energy from one underground feeder. An emergency overhead cable is provided so that the step-down substation can be connected with either frequency-changer station when necessary.



USING EMERGENCY FEEDER AS TIE LINE

At present it so happens that the frequency changer at Fulton is insufficient at times to take care of the load required, whereas the rating of the frequency changer at Fayette is larger than is needed. Therefore the portion of the emergency feeder between Fulton and Fayette is utilized as a 2300-tie line, the main line being disconnected at point *S* on the diagram. This permits proper distribution of the load and eliminates the installation of machinery at Fulton and the expense of constructing a tie line. Arrangements are made so that the 11,000-volt emergency line can be switched back in case trouble occurs in the underground system.

WATT-HOUR METER REQUIREMENTS

Operative Conditions Expected by Purchasers of Alternating-Current Meters Outlined by Foreman

Some of the essential requirements of a meter, if it is to fulfill central-station needs, are as follows:

It must be accurate on all loads from a very small one (say 2 per cent of rated capacity) up to a large overload (say 50 per cent overload). This accuracy must be independent of the character of the load; that is, whether it is constant or variable or inductive. Furthermore, it should not be affected by variations in voltage, wave form or frequency or by ordinary variations in temperature or atmospheric pressure. The internal I^2R losses should be small. The potential losses should not exceed 1.5 watts, and the drop of pressure across the series coils should not be appreciable.

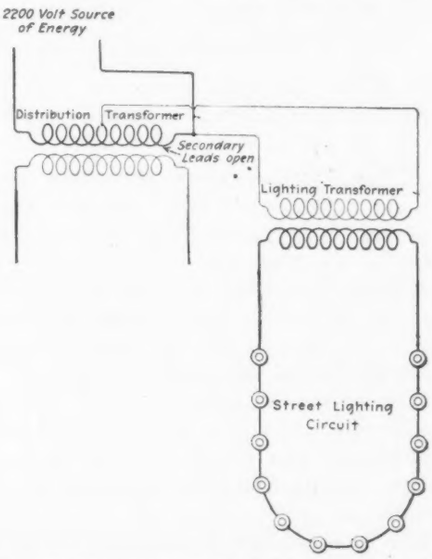
Other conditions equally important to usefulness in an integrating meter are that it should retain its original accuracy for long periods. The construction details should be such that the calibration is permanent. The meter must be dust-proof and moisture-proof to avoid possible deterioration, and it should be light in weight, compact and of a pleasing appearance so that it may be installed in any location. It must be easy to read and test, and its adjustments should be simple and accurate. The methods of hanging and connecting must be simple so that mistakes are practically impossible, yet it must be of a design well adapted to prevent tampering by unauthorized parties.

These requirements were outlined by George M. Hewitt, foreman of the meter department of the Minneapolis General Electric Company, recently.

USE OF AUTO-TRANSFORMER BETTERS THE POWER FACTOR

Distribution Transformer Connected with Secondary Open Improves Street-Lighting Circuit Conditions

After the installation of more efficient lamps on a series street-lighting system, a central station in New York State found that the power factor was very materially lowered, owing to the lower voltage at which the transformers were required to operate. This was due to the fact that the desired illumination could be secured with the more efficient lamps of the old current rating with lower voltage units. To improve conditions a distribution transformer was connected across the source of supply as shown in the accompanying diagram so that its primary acted as an auto-transformer and its secondary was open. The primary was tapped mid-



HOW AUTO-TRANSFORMER MAY HELP POWER FACTOR

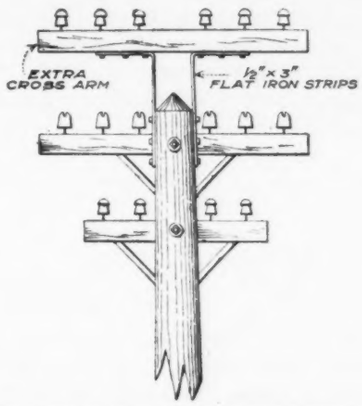
way between the two terminals, 1100 volts being impressed upon the terminals of the lighting transformer. This greatly increased the power factor of the system and obviated the purchase of an additional step-up transformer of correct size. Of course, this connection was facilitated by the fact that the distribution transformer had 50 per cent taps on the primary.

EXTENSION TO POLE TOP PROVIDES FOR EXTRA ARM

Additional Conductor Space Afforded on Pole Line Without Decreasing Minimum Ground Clearance

BY FRANK HUSKINSON

Having a pole already well filled with cross-arms and requiring six additional transmission conductors to parallel this line, an extra cross-arm was attached to the pole as shown in the illustration. Flat iron



EXTRA CROSS-ARM ON POLE-TOP EXTENSION

strips 3 in. by 0.5 in. (7.6 cm. by 1.3 cm.) were attached to the pole near the top and bent at right angles at a suitable distance above the pole top. The extra cross-arm providing for six insulators was attached to these iron strips by means of lag screws. This scheme gave additional height to the pole and eliminated the necessity of another pole line. It has given satisfactory service on a transmission line one mile in length.

METHODS OF IMPROVING SMALL UNDERGROUND SYSTEM

Circuits Installed in Conduit Without Manholes Prove Troublesome in Winter When Distinguishing Marks Are Lost

Until recently the underground system of the Lenox (Mass.) Electric Company consisted of a single distribution network tied together and paralleling without methods of sectionalizing. The effect of local troubles was widespread, often leading to a complete shut-down of service until the disturbance was located. The company serves a small town in the Berkshire Hills and most of the lines are underground. In order to make it possible to install such a system without prohibitive rates a conduit system was installed without manholes, the cable joints being made in 2-ft. by 2-ft. (61-cm. by 61-cm.) holes about 2 ft. deep and brought within about 2 ft. of the ground surface. The holes were provided with iron covers and were supposed to be marked by marble monuments about 18 in. (45 cm.) high. In winter it was found difficult to locate the monuments, many of which had disappeared, and at times several days would be required to localize the trouble. Lately the monuments have been replaced and a number of standard manholes have been constructed in place of the small ground openings formerly used. A considerable number of sectionalizing switches mounted in pillars above ground have been installed, and the localization and isolation of disturbances is thereby facilitated.

WIRE-TENSION BOARD FOR USE IN WINDING COILS

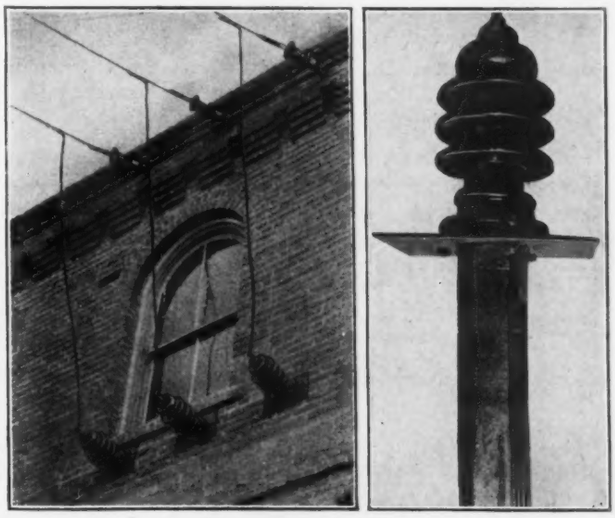
Arrangement of Spools on Board Placed Between Winding Lathe and Wire Reel Affords Flexible Device

Constant tension for coil-winding can be obtained by means of a simple device consisting of eight spools mounted on a board that is interposed between the winding machine and the reel of wire. The spools are arranged in two rows and are supported on bolts that extend through the board. Free movement of the spools is prevented by a spring wound on the projecting bolts and held in place by movable nuts. By adjusting the nuts the desired tension on each spool is had. The device is flexible because the wire may be wound around the spools in a number of ways. Triangular grooves in the wooden spools permit the use of the tensioner with practically any size of wire.

TRANSFORMER BUSHINGS USED AS WALL BUSHINGS

Utilized in an Emergency to Provide Insulation for a Temporary Feeder Which Had to Be Run Through a Brick Wall

When high-voltage leads have to be run through a building wall in an emergency which precludes securing regular wall or roof bushings, standard transformer bushings can be used with good results. The accompanying illustration shows bushings taken from two



TRANSFORMER BUSHINGS HELD AGAINST WALL BY MEANS OF STEEL PLATE

2200-volt, 10-kw. transformers and used to insulate a temporary feeder running through an 18-in. (45.6-cm.) brick wall. Steel plates ¼ in. (6.4 mm.) thick were bolted to the wall and drilled to hold the bushings in position. In order to make a neat installation and protect the stem of the bushing, an 18-in. (45.6-cm.) standard tile was slipped over the bushings.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

THE VALUE OF CHECKS IN PAYING EMPLOYEE PREMIUMS

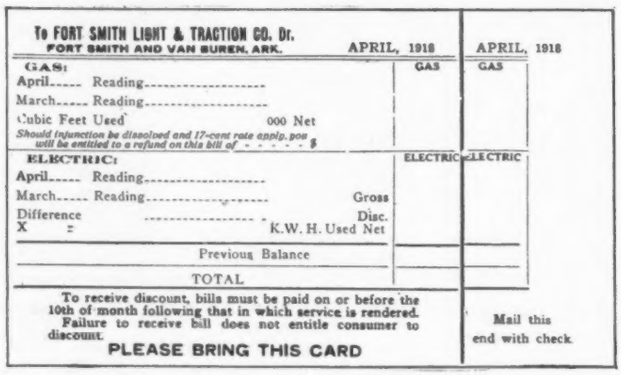
Experience Indicates that by This Means Other Employees Will Be Spurred to Action in Selling Electrical Goods

When the Public Service Company of Northern Illinois first adopted the policy of paying its employees outside of the sales department a 5 per cent bonus on all appliance sales which they made, there was not immediately a great show of interest in the plan. Many of the employees were rather slow to take up the idea as a definite method of adding to their income. It was noted on many occasions, however, that when employees who had succeeded in making a sale received their 5 per cent compensation in the form of a check they took considerable pride in exhibiting it among their fellow employees and thus created a spirit of rivalry which spurred others to interested action. As a result of the definite policy of paying these 5 per cent employees' premiums by check, interest has spread throughout the organization until now a large number are participating in the plan. John G. Learned, under whose direction the plan is being carried out, is a very strong adherent of this method of increasing appliance sales.

GAS AND ELECTRIC BILLS PUT ON SAME POST CARD

A Combination Bill Contained in Small Space—Merchandising Accounts May Be Added on the Same Form

While the post-card bill has been used rather extensively by both gas companies and electric companies, it is rather unusual to find a combination gas and electric company placing both electric and gas bills on the same post card. This practice, however, has been resorted to by the Fort Smith (Ark.) Light & Traction Company in an effort to keep its billing costs as low as possible.



To FORT SMITH LIGHT & TRACTION CO. Dr.
FORT SMITH AND VAN BUREN, ARK. APRIL, 1918

		APRIL, 1918
GAS:	GAS	GAS
April..... Reading.....		
March..... Reading.....		
Cubic Feet Used 000 Net		
Should injunction be dissolved and 17-cent rate apply, you will be entitled to a refund on this bill of - - - - - $		
ELECTRIC:	ELECTRIC	ELECTRIC
April..... Reading.....		
March..... Reading..... Gross		
Difference ..... Disc.		
X = K.W.H. Used Net		
Previous Balance		
TOTAL		

To receive discount, bills must be paid on or before the 10th of month following that in which service is rendered. Failure to receive bill does not entitle consumer to discount.

PLEASE BRING THIS CARD

Mail this end with check.

COMBINATION BILL OF ARKANSAS COMPANY

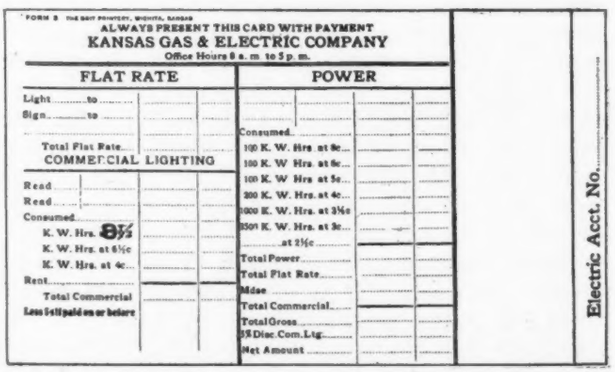
The accompanying illustration shows how the meter readings and the items indicating cost of service are arranged on the card. It is the intention of the auditing department of the company to add a place on this post-card bill later for merchandise accounts, thus further reducing the number of different forms used by the company to cut down billing expense. The company has about 4010 electric meters and 6459 gas meters, making a total of 10,469 meters in service in the two cities of Fort Smith and Van Buren which it serves.

METHOD OF HANDLING BILLING IN CITY OF 70,000

Boys Are Employed in Delivery Work—Advertising Is Wrapped Around Post-Card Bill and Used Like Transparent Face Envelope

Two youths aged about eighteen deliver the 23,000 monthly bills of the Kansas Gas & Electric Company at Wichita, a city of 70,000 inhabitants according to the 1910 census. These boys are paid from $45 to $50 a month. When they are hired they are told that the position is permanent and affords them an opportunity to work up to the next position, that of meter reader, which pays $65 a month with a 10 per cent commission on all appliance sales made.

When the bills are ready for delivery they are first routed by an office girl, who at the same time wraps advertising literature around the post card on which the bill itself is made out. This advertising literature is arranged with a 1-in. by 3-in. cut-out so that the customer's name and address on the post card show through the advertising just as the name and address on a letterhead show through the face of a transparent envelope.



ALWAYS PRESENT THIS CARD WITH PAYMENT
KANSAS GAS & ELECTRIC COMPANY
Office Hours 8 a. m. to 5 p. m.

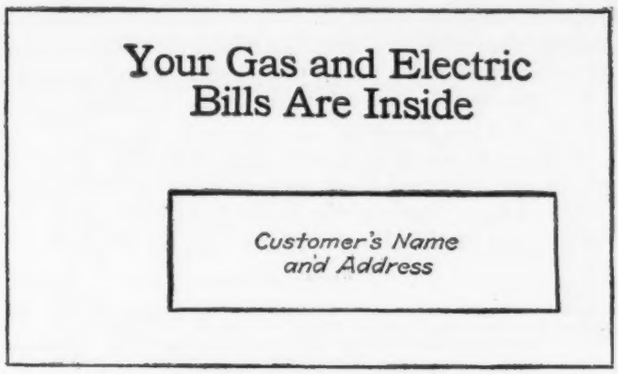
FLAT RATE	POWER
Light.....to.....	
Sign.....to.....	
	Consumed.....
Total Flat Rate.....	100 K. W. Hrs. at 8c.....
COMMERCIAL LIGHTING	100 K. W. Hrs. at 6c.....
	100 K. W. Hrs. at 5c.....
Read.....	200 K. W. Hrs. at 4c.....
Read.....	1000 K. W. Hrs. at 3½c
Consumed.....	3501 K. W. Hrs. at 3c.....
K. W. Hrs. 8%	.....at 2½c.....
K. W. Hrs. at 6½c	Total Power.....
K. W. Hrs. at 4c.....	Total Flat Rate.....
Rent.....	Mdse.....
Total Commercial.....	Total Commercial.....
Less 5 if paid on or before	Total Gross.....
	5% Disc. Com. Ltg.....
	Net Amount.....

Electric Acct. No.....

POST-CARD BILL FORM OF WICHITA (KAN.) COMPANY

This method of combining advertising matter with the bill has been worked out as the Kansas Gas & Electric Company's solution of the problem of using the economical post-card bill and at the same time enjoying the

advantage of sending an advertisment with each bill. The cost of this advertising alone is about $60 per month. Since the United States entered the war the company has made it a practice to include patriotic ad-



HOW ADVERTISING MATTER INCLOSES BILL

vertising in support of the Red Cross, the Liberty loan, "smileage books," etc., on one side of its leaflet while using the other side for promoting the use of electrical appliances.

SUBSTITUTING WOMEN FOR MEN IN UTILITY WORK

Iowa Companies Are Using Them in Meter Departments with Good Results, and Some Are Using Them for District Managers

It seemed to be the general opinion of those who spoke in the discussion at the labor session of the recent convention of the Iowa Section, N. E. L. A., that it would be good policy to secure as early as possible the women who will be needed to take the place of men to be called to the colors. Harold Boehmer of Malvern stated that he had had a woman reading meters for approximately two months and that he was well satisfied with her work. She is also delivering bills. He said she enters the homes more quickly than a man, causing less disturbance. The customers are better satisfied, as she reads the meters with greater accuracy and there is less re-reading to do than formerly.

J. W. Walsh of Burlington expressed the opinion that where organized labor was to be contended with it would be necessary to handle the question of employing women rather carefully.

M. G. Linn of Des Moines stated that his company was using some women as meter readers though still retaining a few men in the department to handle the meters which it would be difficult for the women to get to.

John M. Drabelle expressed the opinion that women could be employed successfully for meter testing and for calculating all power-house records.

A representative of the Lee Light & Power Company, Clarinda, said that the company was using women for collecting and for repairing on the customers' premises, as well as for handling all light supply work. The company has not now a single man in some of its small towns. The local manager is a woman. Arrangements have been made, however, for a man to go to each of these towns once a week. He climbs poles and does the heavy work that women are not physically able to do.

In another Iowa town it was reported that a woman is acting as local manager and has a male "trouble-shooter" under her direction. This combination is working out satisfactorily. All of the companies that were employing women expressed the belief that they were more honest as a rule than men.

READJUSTING LAMP PRICES TO INCREASE HIGH RATE LOAD

Price of 30 Cents on 10-Watt Lamps and 15 Cents on 60-Watt Lamps Helps in Controlling Wattage of Lighting Installations

Realizing the importance of governing as far as possible the size of incandescent lamps for the customer's original installation and for removal purposes, a Middle Western company serving many towns has readjusted its incandescent lamp prices with a view toward increasing the wattage of lighting customers' installations. This company's former lamp schedule and its new lamp schedule, which has just gone into effect, are given in the table.

In connection with this change in prices the commercial head of the company stated that the customer should be encouraged to use either 50-watt or 60-watt lamps, preferably the latter. This can be done by establishing a lower price for that particular lamp. The result will be an increased wattage in the customer's installation, which will be reflected in increased gross income.

It was his belief that this may be accomplished without pronounced resistance since the average customer is subconsciously in a receptive frame of mind for a higher intensity of light in his home because of his frequent direct contact with lighting of high intensity while riding on street cars and while passing through well-lighted stores or sitting in modern theaters. The question of what size of lamp the customer will choose apparently resolves itself into one of salesmanship, so that those having to do with the placing of lamps with customers have an opportunity to prevail upon them to use the large lamp.

Other companies which have considered adopting some such policy as this are of the belief that the same result can be accomplished with less public antagonism by revising lamp prices and adopting a schedule where-

TABLE SHOWING CHANGE IN LAMP PRICES

Size of Lamp	Former Schedule	New Schedule
10-watt	27 cents	30 cents
15-watt	27 cents	30 cents
25-watt	22 cents	30 cents
40-watt	22 cents	25 cents
50-watt	18 cents	20 cents
60-watt	18 cents	15 cents

in all lamps from 10-watt to 60-watt are sold at identically the same price. The representatives of these companies argue that the natural cupidity of the human being may be very largely depended upon to cause him to choose the larger lamp on a schedule of this kind, whereas the inverted schedule is likely to make the customer think that the lighting company is forcing the larger lamps on him against his will.

SURCHARGE METHOD USEFUL

Increases from 15 Cents per Kw.-hr. to 20 Cents per Kw.-hr. Successfully Made by This Plan

In several small cities of the Central West served by one company the top step of the rate for electric service was 15 cents. In spite of this apparently high price which the company was getting it was not able to make money enough to pay its operating expenses and was faced with the necessity of shutting down its plant or increasing the price which it knew was already high. Realizing that electricity at 20 cents a kilowatt-hour can hardly compete with gasoline or kerosene lighting, the company decided to let its base rate remain at 15 cents per kilowatt-hour and add a surcharge of 5 cents per kilowatt-hour. While this plan in effect increases the rate per kilowatt-hour to 20 cents, it also holds out hope to the customers of the company that the increase is of a temporary nature. The result is that the rate increase has gone into effect and not many customers have asked to have their service discontinued. The manager of the property is certain that if a straight increase in rates to 20 cents per kilowatt-hour had been made effective, the curtailment of service would have been quite disastrous.

WINNING PUBLIC BRINGS COMPANY INCREASED INCOME

Newspaper Advertising and Attention to Office Detail Under a New Manager Accomplish an Apparently Miraculous Result

One year and three months ago a combination electric light and railway company in a Southwestern city of about 20,000 inhabitants was losing money. The public was at loggerheads with the company and all of the newspapers in town were deriding it in sarcastic editorials. In fact, the whole situation was one that demanded drastic action. Then a change was made in managers. Shortly afterward things began to take a turn for the better. In a little less than one year the company was on a paying basis, and during the first four months of the second year of this new manager's tenure of office the company's earnings showed an increase of 108 per cent over the same period for the preceding year.

A discussion with the new manager of the underlying causes of the change disclosed his belief that the increased revenues are largely due to the change in public attitude. When he took the reins one of the first important things he did was to begin advertising in the newspapers, setting forth the company's point of view. This advertising was of a general good-will character, and attempted to teach the public that a utility can be in sympathy with the city it serves and is not necessarily soulless. As a result the newspapers soon desisted from the publication of sarcastic editorials, and the men who had been writing them began to admit publicly that the new manager was not "the autocratic price-boosting highbinder" they had called him upon his arrival.

Another thing which aided in winning the public was prompt and strict attention to detail in the office. Instantaneous replies to all telephone calls were insisted on. Arrangements were made so that there would be a minimum of waiting for customers who came to the office to pay bills. Repairs were effected on the tracks of the street railway where large numbers of automobiles crossed them, so that these crossings became a part of the easy-riding boulevard instead of notorious automobile-spring breakers. In addition to this, prompt attention was given to all complaints of customers at an "adjustment bureau" which was established expressly for the purpose.

The net result of this work has been that the company's earnings have taken on a satisfactory complexion and that the attitude of the public is now such that the newspapers in the city would not dare to attack it.

UNIFORMS FOR WEAR BY WOMEN EMPLOYEES WHO MEET PUBLIC

Kansas City Light & Power Company Supplies Plain Dresses at Cost of $3 Each and Launders Each Uniform Twice a Week at Cost of 25 Cents

All women employees of the Kansas City (Mo.) Light & Power Company who meet the public on the company's first-floor office and salesroom are dressed in a standard uniform. The uniforms, which are neat but plain dresses, are made of cambric with poplin collars

UNIFORM OF KANSAS CITY WOMEN EMPLOYEES

and cuffs. The total cost of material and making is $3 per uniform. The company also provides free laundry service for these uniforms twice a week, which costs in addition 25 cents for each dress.

Uniforms were provided in order to prevent discrepancy in costume. Some of these girls have recently taken the places of young men. The company formerly employed boys in its lamp-renewal department, paying wages ranging from $50 to $60 a month. The boys were a source of continual trouble to the company, particularly because arguments were constantly arising between them and other youths whom customers of the company would send to the lamp-renewal department to transact their business.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Automatic Extinction of Fires in Transformer Chambers.—In a recent issue of the *Elektrotechnische Zeitschrift* an apparatus for automatically extinguishing fires which is specially applicable to transformer chambers, oil switches, etc., is described. The principle is similar to that of other forms of automatic extinguishers, except in details.—London *Electrician*, May 24, 1918.

Faults of Direct-Current Motor Windings.—GORDON FOX.—Methods of local faults and suggestions for making temporary repairs are discussed in this article. In addition common faults that occur in the armature and field windings of direct-current motors or generators are outlined and the methods of diagnosing these troubles are explained. The tests include the trouble lamp test for a dead ground, trouble lamp and receiver test for a partial ground, high-potential tests for grounds, magneto tests for open circuits, short circuits and grounds and buzzer tests for open and short circuits and grounds. The use of jumpers for repairing both lap-wound and wave-wound armatures is mentioned.—*Southern Engineer*, May, 1918.

Elementary Principles of Continuous-Current Armature Winding.—F. M. DENTON.—This article concludes with a discussion regarding the number of commutator segments and armature slots to use and the effect that the number of slots has on commutation. A schedule of winding rules applying to simplex-lap, multiplex-lap, simplex-wave and multiplex-wave windings is presented.—London *Electrician*, May 3, 1918.

Increasing the Efficiency of an Electric Generator.—CH. VALLET.—First part of a study of the heat losses of an electric generator in which the importance of ventilation is dwelt upon and air-washing apparatus advocated. The double advantage derived from ridding the air of impurities while at the same time lowering its temperature is pointed out.—*L'Industrie Electrique*, May 25, 1918.

Selection of Direct-Current Motors.—In choosing a motor for any application careful consideration should be given to the motor characteristics. The article deals with service conditions, starting and speed adjustments and direct-current connections.—*Southern Engineer*, June, 1918.

Lamps and Lighting

Industrial Lighting.—F. H. BERNHARD.—That the industries need more light for war-time conditions and that central stations can serve the country by developing better lighting are discussed under the following headings: Central stations prompt in meeting war power needs; necessity for intensive production calls for best possible lighting; improved lighting not only for war but to meet after-war conditions; function of the central station in improving industrial lighting, and offsetting the loss from daylight saving.—*Electrical Review*, Chicago, June 15, 1918.

Choice of Current for Mazda Series Lamp.—W. P. HURLEY.—The current ratings which have been most commonly used in this country were chosen to agree with those which were selected in developing arc lamps. Dealing with standardization, the writer says that the 6.6-amp. or 7.5-amp. street series lamps are best and that much of the distribution apparatus used with street-lighting systems for inclosed carbon arc lamps and Mazda B lamps is of this rating, the 6.6-amp. size predominating.—*Electric Journal*, June, 1918.

Generation, Transmission and Distribution

Control of Large Amounts of Power.—E. B. WEDMORE.—This paper contains an extensive discussion on limitation of disturbances, improvement of power factors, interconnection of stations, rupturing capacity of oil switches, rating of reactors, arrangement of busbars, transfer of load through reactors, design of reactors, and heating and stresses due to heavy currents. Limitation of disturbances is considered by several means, among them being sectionalization, use of generator, feeder and busbar reactors, and the employment of other protective apparatus such as relays.—*Journal of Institution of Electrical Engineers*, London, May, 1918.

Fuel Economy in Hand-Fired Plants.—To enable the plant owner to determine whether or not his installation conforms with the best practice and to check up his methods of operation information has been compiled in one pamphlet under the following headings: Principles to be observed in firing; features of boiler installations; stocks and breechings; feed water and fuel; steam-piping requirements, and the recording of operations.—*University of Illinois Bulletin*, April 1, 1918.

Lightning Protection for Special Transmission Lines.—G. C. DILL.—Fuses that automatically disconnect the electrolytic lightning arresters are advocated, but it is pointed out that the space taken up by the fuse and the loss of protection until a blown fuse is replaced are objections. With indoor installations the space consideration is of some importance, but on outdoor installations where space is no consideration this factor is of considerably less importance. The fuses furnished on electrolytic arresters are usually sufficiently heavy so that they will only burn out under the most severe conditions. In such cases it is necessary merely to replace the burnt-out fuse, which takes only a few moments, and then, in case of the low film, impress a voltage of about 220 across each cell through a lamp bank to build up the film. If the fuse is not present to take care of these cases, there is the possibility of serious damage or destruction of the arrester and necessity of rebuilding it and in many cases waiting for repair parts to be supplied from the factory, which

would leave the arrester out of service and the line unprotected for a much greater length of time than is required to replace a fuse. Various combinations of horn gaps, choke coils, electrolytic elements and fuses on single-phase, two-phase and three-phase systems are discussed and illustrated.—*Electric Journal*, June, 1918.

New High-Speed Hydraulic Turbine.—J. REYVAL.—Description of an Ascher-Wyss hydraulic turbine lately installed at the hydroelectric central station at La Vourdiat, France. This turbine has the following characteristics: (1) elevated waterwheel, facilitating the direct attachment of the electrical machines; (2) a guaranteed output of 83 or 84 per cent without drop in speed; (3) high speed and large output under variable fall, the speed remaining constant; (4) with reduced fall, because of floods, and constant speed, the variations of power are relatively small. This turbine appears to be designed for use where the fall is low and the flow very variable. It was tried with satisfactory results with three different water powers of which the heads averaged 1.6 m., 2 m. and 3 m.—*Revue Générale de l'Electricité*, June 1, 1918.

Installations, Systems and Appliances

Recent Protective Relay Developments.—E. A. HESTER.—In this article temperature relays are considered. Relays are described in which mercury is used, also those of the Wheatstone bridge, search-coil type, induction and moving-coil types. Watt relays, voltage relays, reverse-phase relays and transfer relays are mentioned among other types which have been recently developed. Methods of connecting and operating them are also explained.—*Electric Journal*, June, 1918.

Rolling Mills and the Electric Drive.—L. ROTHERA.—The author refers to the increasing development of electric drive as compared with steam methods in rolling mills and presents some diagrams showing the relation between the power demanded and time in typical processes. The advantages of the electric drive can be summarized as follows, he says: (1) Economy of working, i.e., reduction in cost per ton of material rolled. This results from the great rapidity of working and high efficiency of the electric plant at all loads. This economy of working persists throughout the whole life of the plant. (2) Reduced space taken up, partly on account of the small size of a motor as compared with its output, and partly due to placing the motor in the most convenient position, without having to consider the run of steam pipes or the relative position of the boiler house. (3) Ease of control, such as stopping, starting or varying the speed of the drive. (4) Constant check on the power consumed; a recording instrument gives immediate information of any abnormal consumption of power, thus enabling defects to be promptly located and remedied. (5) Increased output from a given plant, resulting from the large overload capacity and constant speed of the electric motor under all conditions of load. (6) More uniform drive; the turning moment of a motor is constant for any position of the rotor, whereas a steam engine's turning moment fluctuates, depending on the position of the cranks. (7) Smaller initial cost, especially where electric power is available from a neighboring central station and additional boilers would be required in the event of a new steam engine being installed.—London *Electrician*, May 24, 1918.

Electrophysics and Magnetism

Effect of Electric Field on the Spectrum of Hydrogen; Part II.—TOSHIO TAKAMINE and USABURO YOSHIDA.—The authors observe that the outer components of the Balmer lines often extend beyond the unaffected neighboring lines belonging to the secondary spectrum. In other words, the branches of the affected Balmer lines cross through the secondary spectrum lines which lie near them. Judging from the phenomenon observed, which appears to show no mutual influence between the secondary lines and the Balmer lines, it seems probable that they are due to different sorts of carriers. They also refer to the observations of other investigators.—*Memoirs of the College of Science*, Kyoto Imperial University, October, 1917.

Tests of Aluminum.—An official note of the French Electrotechnical Committee gives the results of its investigation into the mechanical, chemical and electrical properties of aluminum. The Central Electrical Laboratory was intrusted with the determination of the resistivity and the temperature coefficient of the aluminum used for transmission lines, and a full account is given of the way in which its tests were made. At 20 deg. C. the resistivity of various samples, in microhms per centimeter, ranged from 2.803 to 2.971 and the coefficient of variation of resistance with temperature, between the limits of 20 deg. C. and 60 deg. C., ranged from 0.00364 to 0.00444 per cent.—*Revue Générale de l'Electricité.*

Experimental Study of Vibrations.—A. POUCHOLLE.—The author in his investigation of vibrations describes a modification of Atwood's machine which plots experimentally a graph of vibratory motion. The paper contains numerous diagrams of the apparatus and the curves traced by it.—*Science Abstracts, Section A*, May 31, 1918 (abstracted from the *Revue Générale de l'Electricité*).

Oscillations in a Field of Force.—A. SCHMIDT.—The paper contains an analysis of the theory of oscillations in a variable field of irregular outline in connection with observations of terrestrial magnetism.—*Science Abstracts, Section A*, May 31, 1918 (abstracted from *Preuss. Akad. Wiss.*, Berlin, Ber. 46, 1917).

Electrochemistry and Batteries

Electric Storage Batteries.—Concluding section of an article on this subject, this part dealing particularly with the rating of batteries, maintaining electrolyte efficiency, specific gravity readings and efficiency of batteries. It is pointed out that some impurities will exist in the water used for the replacement of that evaporated, but that under no conditions should such impurities exceed the maximum limits as follows: Suspended matter, trace; nitrates as NO_3, one part per 100,000; total solids, ten parts per 100,000; calcium and magnesium oxides, four parts per 100,000; iron, 0.05 part per 100,000; organic matter, 0.10 part per 100,000; nitrates as NO_3, 0.50 part per 100,000; chlorine, one part per 100,000.—*Power Plant Engineering*, June 15, 1918.

Units, Measurements and Instruments

Variance of Measuring Instruments.—FREDERICK J. SCHLINK.—This subject is considered particularly with regard to its relation to accuracy and sensivity.

Summarizing, the author says that the factors of maximum or mean accuracy, sensitivity, variancy, etc., may be referred to the total range of graduation instead of to particular values of the measured quantity under observation to arrive at a "figure of merit" for any instrument whose characteristics are being determined.—*Journal of Washington Academy of Sciences*, June 19, 1918.

Telegraphy, Telephony and Signals

The Quenched Spark.—V. PIECK.—Abstract of a dissertation by Gottingen referring to an elaborate investigation of the phenomena associated with the quenched spark. The results obtained show that the quenching effect increases with higher gas pressure and greater spark length, but the rate of increase of the effect with spark length and gas pressure diminishes as the spark length increases and the gas pressure is raised. The effect is approximately the same in air, CO_2 and nitrogen, but is much better in hydrogen. Experiments on the effect of the material constituting the electrodes show that the nature of the material has a considerable influence. A greater quenching effect is obtained with magnesium electrodes than with silver electrodes in nitrogen. The shape of the electrodes, whether rods or plates, also has a decided effect, and curves are given illustrating the variation in the results with two plate electrodes, two rod electrodes, or one rod and one plate. The effect of varying the frequency of the oscillations was investigated in air and in hydrogen, and it was found with both gases that the quenching effect was greater for short waves than for long waves at the lower gas pressures used. With the higher pressures there was little difference between the two. The latter part of the paper gives a theoretical discussion of the subject, with special reference to the experimental results obtained.—*Science Abstracts, Section A*, May 31, 1918 (abstracted from *Annalen der Physik*, Feb. 22, 1918).

Miscellaneous

Electric Cast-Steel Chain.—W. L. MERRILL.—The first attempt to produce an electric cast-steel anchor was made by die-casting the links in a form. Afterward the studs were placed in position, the same as in handling welded chain. It was found, however, that while it was possible to make die-cast chain from electric steel, the method was not feasible for a large production since there is a critical time at which the molds should be opened to prevent cracks due to shrinkage. If opened too soon, the metal is congealed. Therefore dry sand molds were resorted to and successful chain was made by this method.—*General Electric Review*, June, 1918.

Substitutes for Copper in Germany.—Copper can now be obtained in Germany only for military uses. For other needs iron and zinc have been substituted. Thus iron conductors are taking the place of copper wire for aërial transmission. It is recommended that the diameter be not under 6 mm., that special apparatus be used in unrolling and flattening the cable to avoid kinks and breaks, that rust be prevented by careful attention to galvanizing, that soldered joints of a suitable thickness be used, that all the poles be furnished with lightning rods, as iron conductors become heated more easily than copper ones, that the junction boxes between connections in iron and those in copper be made absolutely proof against humidity, and that, in view of the greater elasticity of iron, poles, cross-arms, insulators and all appurtenances of the line be on a stronger scale. The estimated cost of a two-conductor iron line 50 m. long and carrying a direct current of 7 kw. is 154 marks, as against 128 marks for copper; for a 100-m. line, 540 marks as against 295 marks. As regards zinc conductors, their conductivity is 29 or 30 per cent that of copper. Their durability is still in doubt, but two points have been established: zinc will not resist a temperature above 130 deg. and it offers poor resistance to tension, the treated zinc used for electrical purposes developing a tendency to assume the texture of the commercial article. In cost the comparison ordinarily favors copper lines, though the price of the treated zinc is more per kilogram than that of copper in time of peace. In view of the greater resistance of the iron wire and the greater conductivity of the zinc wire, attempts to combine them so as to obtain both advantages are being made.—*Revue Générale de l'Electricité*, June 8, 1918 (abstracted from *Annalen für Gewerbe und Bauwesen*).

Electric Welding in Shipbuilding.—H. A. HORNOR.—Different methods of welding by electricity are outlined and their relative merits and most suitable applications are mentioned. Spot welding, though first applied to thin sheet steel, has now been adapted to very thick plating. The author goes on to observe that spot welding and arc welding will be most generally used for ship-construction purposes, the latter probably most extensively. He concludes that electrically welded ships can be built at least as strong as riveted ships. Furthermore, ships designed to be riveted throughout can easily be modified so as to adapt them to extensive electric welding without departing appreciably from the use of materials originally required, with a considerable saving in cost and in the time required for hull construction. Ships especially designed for electric welding can be built at a saving of 25 per cent in both labor and material over present methods and in less time; moreover, a class of labor not now used for shipbuilding can be largely employed.—*Nauticus*, June 1, 1918.

Effects of Moisture on Spontaneous Heating of Coal.—S. H. KATZ and H. C. PORTER.—With thoroughly dried Illinois coal the rate of oxidation at ordinary temperatures is greater than with a similar sample of moist coal. On the other hand, a thoroughly dried sample of Pittsburgh coal oxidizes at a slower rate than a moist sample of the same coal. This difference between the two coals probably explains the discrepancies in the observations of different experimenters and indicates that the rates of oxidation of different coals are not affected uniformly by moisture, says the author. Under actual conditions of storage both the coal and the air always contain moisture, hence it seems doubtful whether water, other than the excess that actually wets the coal, plays an important part in the rate at which coal oxidizes at the lower temperature. The experiments conducted on a working scale by Fayol, who could find no influence of wet weather on spontaneous combustion, and by the New South Wales commission, which found that actual wetting of the coal produced a cooling effect during storage, tend to confirm this idea.—*Technical* ***Paper 172, Bureau of*** *Mines.*

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities
in the Technical, Commercial and
Manufacturing Fields

ECONOMY PROGRAM FOR POWER PLANTS

State Administrative Engineers Meet in Washington to Develop Plan of Organization for Conservation of Fuel

State administrative engineers of the United States Fuel Administration held a conference in Washington on June 28 and 29, discussing the plan of organization in connection with conservation of fuel in power plants throughout the United States.

This plan is the result of conferences with the federal administrators and their committees for the group of states which together consume about 70 per cent of all coal used in the United States, exclusive of railroads. The plan has received the indorsement of all of these states, as well as approval by the United States Bureau of Mines and the committee of consulting engineers on conservation and publicity, which represents the Engineering Council of the four national engineering societies.

It is considered most important that all existing fuel conservation committees, committees of chambers of commerce and national defense, manufacturers' associations and other bodies be continued in full force, and that the co-operation of such organizations be obtained.

The administrative engineer in each state will work under the supervision of the present federal administrator. No separate or new organization is contemplated, but sufficient addition to the working force in each state will be made to insure efficient execution of the new function.

The ratings of plants will be based upon recorded answers to questions, each of which will be given a value depending upon its relative importance to the other questions. Depending upon the efficiency of methods in use in any plant, it may be rated in Class 1, 2, 3 or 4.

The administrative engineer in each state will have supervision of electrical and mechanical problems connected with fuel conservation activities contemplated under this plan.

In advance of the first inspection a questionnaire is being sent to every power plant in each district, with notice to the owner that within, say, sixty days his plant will be inspected personally and the questionnaire will be checked up by the inspector upon his visit. This action will give a reasonable time to any plant owner to improve the operation of his plant and conform to recommendations before his plant is actually rated. Thus, when the inspector calls for the purpose of obtaining and checking up the information form, the plant may receive a much higher rating than would have been the case if no time were allowed between the sending and collecting of the questionnaire.

It is recommended that a board of competent engineers be attached to the conservation committee in each state; also a corps of lecturers to arouse public interest and disseminate engineering information.

As the work develops, still further constructive assistance is contemplated for helping owners to bring their plants up to a high plane of economic operation.

TO THE CENTRAL STATION AND THE ISOLATED PLANT

If a Connection Can Be Made That Will Save Fuel, the Fuel Administration Asks That It Be Done

Active measures for fuel conservation are being urged by the United States Fuel Administration.

A letter addressed by the administration to central-station executives and isolated-plant owners urges them to consider their relationship to each other, saying in part:

While in certain sections of the country the central stations are operating under maximum load, there is available in other sections a surplus of primary, secondary and off-peak power which, if utilized, would considerably decrease the shortage.

The Fuel Administration urges every central-station executive and isolated-plant owner to consider their relationship to each other. If a connection can be made that will save fuel, the Fuel Administration asks that the central station and isolated plant form such connection. If the loads of two or more plants could be handled, with less consumption of fuel, by one of these plants than by any other method, the administration urges that this arrangement be made without delay.

Drastic measures for conserving fuel have been unavoidable in the countries of our allies. In the face of our serious shortage, it may become necessary for the Fuel Administration to discriminate in the distribution of fuel between industries essential and those least essential to the war program and between efficient and less efficient plants. Therefore we appeal to every power-plant owner to investigate immediately whether he can or cannot make connection with the central power plants or in some other way assist to the utmost in the conservation of fuel essential to our country. He will thus assist the Fuel Administration to avoid such extreme measures as otherwise may be inevitable.

The order of the administration curtailing unnecessary lighting, which will go into effect shortly, is far-reaching. As now proposed, the order restricts display illumination, store-window illumination, electric advertising and other forms of lighting, which in ordinary times are considered legitimate merchandising propaganda, to four nights a week in the Eastern States, where coal is particularly short, and to two nights a week in other parts of the country.

This is to be followed by another order, in preparation, establishing rules for lighting and heating large public buildings, including office buildings, hotels and apartment houses. These regulations will reduce the present practice very considerably. The public will be asked at the same time to reduce lighting in homes.

For the Economy Service Outlet Campaign

The feature of the September service outlet campaign of the Society for Electrical Development, New York, will be a poster in six colors by Vincent Aderente, which won the "public choice" prize in the society's poster contest. Hangers for window displays and other advertising will be sent broadcast, along with other liberal supplies of display material. The society will furnish dealers, contractors and jobbers with special co-operative sales helps, literature, cuts, slides and movies.

PROGRAM FOR THE NATIONAL CONTRACTORS' CONVENTION

Full Week of Work Planned for the Cleveland Meeting and Attendance Prospects Are Excellent.

Advance registration for the annual convention of the National Association of Electrical Contractors and Dealers, to be held at the Hollenden Hotel, Cleveland, on July 15 to 20, is promising for an excellent attendance, said H. C. Brown, the secretary, in New York on Wednesday of this week. The program follows:

Monday, July 15.—10 a.m. and 2 p.m., meeting of executive committee.

Tuesday, July 16.—10 a.m., meeting of executive committee. 2 p.m., meeting of state secretaries.

Wednesday, July 17.—10 a.m., opening of the convention, A. L. Oppenheimer, president Electrical Contractors' Association of Cleveland; address of welcome, Harry L. Davis, Mayor of Cleveland; response, W. Creighton Peet, national chairman, New York; address, William Ganson Rose, president Cleveland Advertising Club. 2 p.m., "Scientific System of Wage Adjustment," L. K. Comstock, New York; labor-cost data "round table" conference, J. N. Pierce, Chicago, chairman labor committee; F. W. Lord Company, and Estimators' Club of Chicago. 9 p.m., reception and dance.

Thursday, July 18.—10 a.m., "organization," James R. Strong, past-president National Electrical Contractors' Association; "The Goodwin Plan," William L. Goodwin. 2 p.m., "The Electrical Contractor-Dealer in War Time," Sullivan W. Jones, Washington; "The Application of Electricity to Industrial Plants," Dwight D. Miller, Society for Electrical Development, Inc.; "Differentials from a Legal Standpoint," Franz Nielsen, association attorney, New York.

Friday, July 19.—10 a.m., report of resolutions committee on proposed changes of national constitution and by-laws; "Credit and Accounting," J. E. Sweeney, Waterloo, Iowa; "How to Open a Retail Electric Shop," R. E. Flower, Cleveland; "The Real Causes of Prosperity and Depression," George McIlwain, Babson Statistical Bureau, Wellesley Hills, Mass. 2 p.m., "Farm Lighting," Evan J. Edwards, Cleveland; "The Goodwin Question Box," W. L. Goodwin. 6.30 p.m., dinner dance.

Saturday, July 20.—10 a.m., meeting of executive committee.

All meetings, including those of the national executive committee, are open to all persons who wish to attend.

OPENING SESSIONS OF THE OHIO CONVENTION

Reports of the Committees on Illumination, Meters and Station Operation Presented on Wednesday at Cedar Point

Opening sessions of the twenty-fourth annual convention of the Ohio Electric Light Association at Cedar Point, Ohio, on July 10, 11 and 12 bore out the prediction that this year's meeting, following the postponement of last year's meeting, would be a good one. Reports of the committees on illumination, on meters and on station operation, presented respectively by D. L. Gaskill of Greenville, George A. Snider of Toledo and Henry B. Bates of Cleveland, were discussed fully.

The spirit of the meeting indicated that central-station managers will patriotically assist in encouraging the purchase of efficient tungsten lamps to replace burned-out and inefficient carbon and "gem" lamps. No wholesale change can be contemplated, however, because it would require the entire output of all American lamp factories for two years to effect a complete substitution of tungsten for carbon and "gem" lamps.

Discussions of voltage standardization indicated a continued and marked trend upward and toward 110, 115 and 120 volts, not only in Ohio but in many other states. Assistance which central stations have given lamp companies in working toward standardization has been a large factor in holding down the prices of lamps and will continue to be a factor. The illumination committee proposes to inaugurate a policy of holding open meetings and to begin a popular campaign of education on good lighting. The discussions on the meter committee and the station operating committee reports dealt largely with methods of securing and handling labor.

Western Society Holds Fuel Meeting

At a recent meeting of the Western Society of Engineers devoted to the subject of fuel supply David Moffat Myers, consulting engineer for the federal Fuel Administration, explained the government's coal-saving and plant-inspection plans. An animated discussion was participated in by Prof. H. H. Stoek, Dr. F. C. Honnold, C. W. Naylor, Osborn Monnett, A. L. Langtry, R. H. Holbrook, A. Bement and Robert Kuss.

Attitude of the War Industries Board

Point of View of the Washington Authorities on Questions Touching the Supply of Raw Materials for Electrical Manufacturers and the Control and Distribution of Their Products

This is a complete copy of Bulletin No. 9 of the General War Service Committee of the Electrical Manufacturing Industry, issued under date of July 9 and constituting a report of the conference with the War Industries Board regarding the listing of individual plants for material requirements. An unofficial report of this conference was published in the ELECTRICAL WORLD of July 6, page 23.

AT THE war service convention of the manufacturers of electrical apparatus in the latter part of May the steel situation had careful consideration and their War Service Committee was asked to obtain accurate information at Washington as to the proper steps to be taken to assure a continued supply of steel and iron products. This situation was especially acute because of the methods of manufacture in, and the deliveries required of, the electrical industry. In most cases the articles are manufactured for stock and the cycle of manufacture is very much longer than the deliveries required by the government to meet its essential war needs. Furthermore, the orders for stock cover large quantities of each class and size of products, which are later distributed throughout multitudinous individual orders to meet both the direct and indirect requirements of the United States government and its allies and those of all essential industries.

JOINT CONFERENCE WITH PRIORITIES BOARD

In pursuance of the request made, the General War Service Committee of the Manufacturers of Electrical Apparatus arranged for a joint conference with the Priorities Board and the Director of Steel Supply, which was held at Washington on June 24. At this conference were present fifteen chairmen of group committees in both the apparatus and supplies divisions of the industry, into whose manufacture steel and iron products enter as an important raw material.

A preliminary meeting, attended by the manufacturers only, was held in the morning, in order to formulate definite recommendations to be placed before the War Industries Board and to consider any concrete problems affecting the supply of raw materials to the electrical industry.

In the afternoon the war service committees met with E. B. Parker, Priorities Commissioner; J. Leonard Replogle, Director of Steel; C. K. Foster of the priorities committee, and Walter Robbins, chief of the electrical and power equipment section—all of the War Industries Board.

The following recommendations, formulated at the morning conference, were presented, covering the problem of stock manufacture:

1. That the individual manufacturing companies in the electrical industry be given some form of preference listings for the supply of steel products.
2. That on the basis of proper information as to the character of the current business done, and of any necessary general guarantee or pledge as to the ultimate use of the finished products manufactured from the steel so supplied, priority certificates be issued on application of individual manufacturers covering steel to be used in manufacturing for stock.
3. That each company on the preference listings furnish: (a) Information similar to that required on P. L. Form No. 3 regarding all unfilled sales orders on hand June 1, 1918; (b) also on the first of each month thereafter a monthly report similar to P. L. Form No. 3 based on business entered during previous month; (c) in both cases the per cent of normal capacity.
4. That if the preference listings of individual companies for steel and the form of monthly information suggested above can be adopted, the detailed information requested with each priority certificate application for steel be simplified.
5. That any extension by the War Industries Board of government regulation to other raw materials be properly co-ordinated with any plan adopted or perfected for steel.

In considering these recommendations, the representatives of the War Industries Board very forcibly brought out the fact that, in order to adopt the plan proposed, it would be necessary to have detailed information, comparative over the past year, regarding the consumption of the various grades of raw materials, the stocks of raw materials now on hand, estimated requirements for the six months, the classes of apparatus and supplies manufactured and the essential character and the volume of business done.

After considerable discussion, the officials representing the War Industries Board offered general acceptance of the principles set forth in the recommendations, authorized broadening the plan so as to include other important materials and referred to a committee of manufacturers and Mr. Robbins the working out of all details. A committee of six was chosen from the war service committees in attendance.

Following an agreement to these principles, Judge Parker took the opportunity to urge upon the electrical industry the absolute necessity of conservation in the use of all raw material and the elimination as far as possible of uses of electrical apparatus and supplies which can be placed in the luxury class or which do not contribute to the winning of the war or to the general welfare. Judge Parker referred to the energy which had been shown by the electrical industry in developing new uses for its products and in promoting their sale, and urged the modification of these methods under the present emergency to apply only to essential needs. To use his own word, the manufacturers present were "drafted" to see that all manufacturers in the electrical industry are committed to the policy of conservation and to the direction of all efforts toward what contributes most to the winning of the war.

THE MANUFACTURERS' PROBLEMS

The following specific problems were submitted by the manufacturers:

1. What possibility is there of stocking up on both raw steel products and finished electrical products before winter sets in, in order to avoid or assist in the solution of the transportation difficulties of next winter?

It was stated that any effort in this direction in connection with raw materials, even though desirable,

would merely add to the acuteness of the present shortage and would therefore be inadvisable. In relation to finished products, however, any distribution to strategic points which would facilitate transportation problems during the winter was recommended.

2. What information from the manufacturers regarding the distribution of small electrical supplies through the dealer or jobber for essential uses and purposes will permit of manufacturer having proper recognition in his supply of raw materials for essential business so distributed?

It was recognized that a large amount of essential material and supplies can best be distributed through dealers and jobbers, but in so doing steps must be taken to insure the proper use and conservation of materials and supplies in the hands of dealers and jobbers. Dealers and jobbers should be brought within the limitations of any pledge taken by individual manufacturers, and "each individual manufacturer should exercise policing power in this respect with the dealers and jobbers."

IMPORTANT NOTICE

By agreement with the government, we are conserving our stock of materials and finished products for direct and indirect government requirements and have only slight discretion in the matter.

If you favor us with an order—if for government work—give name of the first contractor, the government and departmental order numbers and the priority certificate numbers.

IF NOT for government work, state the name of the ultimate user, character of product produced and relation of apparatus or supplies thereto.

WITHOUT THE ABOVE INFORMATION WE CANNOT ENTER YOUR ORDER.

FORM OF NOTICE TO CUSTOMERS

3. Does the granting of an export license by the War Trade Board carry with it the necessary recognition of a supply of materials for the manufacture of the product exported?

This does not follow, because the War Trade Board considers the matter from the standpoint of trade relations with various countries and not from considerations of shortage of supply within the United States. In data furnished by the electrical manufacturers an opportunity will be given to show what part of their business enters the export field.

The following problem was also considered by the manufacturers, but not submitted to the War Industries Board:

Is there any information or statistics regarding the use of electrical products or supplies not contributing directly or indirectly to the war or the production of war materials, although promoting the general welfare, which, if placed in the hands of the War Industries Board, would permit of such uses being given careful consideration for some form of preference listing?

It was felt by the manufacturers at the morning conference that any direct uses of electrical apparatus and supplies, such as motor-driven labor-saving devices for either home or the office, can best be handled by the manufacturers of such devices, and that restrictions placed on these indirect industries and uses of electrical material will naturally influence the manufacture of such electrical apparatus and supplies.

At the conference between Mr. Robbins and the committee of manufacturers the following procedure was arranged:

1. A pledge to be taken by the manufacturer for himself and his organization similar to the pledge of the steel manufacturers.
2. Form P. C. 20 of the priorities committee covering requirements for raw material.
3. Form P. C. 21 of the priorities committee—a monthly report of operation.

The pledge and above forms are sent herewith in triplicate, two copies for your use, and the originals to be mailed to the Electrical and Power Equipment Section, War Industries Board, Washington, D. C. Additional forms will be supplied on request by the priorities committee.

Circular No. 4 of the priorities committee, bearing date of July 1, 1918, gives full information as to the method of obtaining materials under the above plan.

In order to obtain uniform practice a sample form under caption "Important Notice" is sent herewith for use in calling attention to the pledge. This is to be printed by each manufacturer over his own name to be attached to all his quotations, proposals, etc., to insure his obtaining detailed information necessary to determine the proper priority classification of the order. Each manufacturer at his own option can prepare additional blank forms on which the necessary information can be furnished by the purchaser.

Electrical Manufacturers' Pledge

For myself, my corporation, or my firm, I pledge

I The conservation of all raw materials and supplies now on hand or later to be issued to me;

II The maximum possible utilization of all materials and supplies for essential war purposes;

III The prompt production and delivery of the largest possible quantity of finished product that is or shall be required by the United States Government for the interests of itself or its allies;

And I further agree that all other lines of our business shall be subordinated to this pledge, and

All this in accordance with the suggestion of the War Industries Board.

_____

_____

The war service organization of the electrical industry has established a practical working relation with the War Industries Board, and expresses its apreciation of the liberal spirit in which material problems affecting the electrical industry are being considered by the government officials.

This report was signed by A. W. Berresford, Clarence L. Collens, 2d., James C. Hobart, J. R. McKee, William Wallace Nichols and Charles A. Terry, constituting the committee.

Form P. C. 20, referred to in the foregoing bulletin, is for requests to the priorities committee for favorable consideration "for general material needs in advance of manufacture to insure maximum continuous production."

Among the definitions of terms are:

"Direct government order" signifies any order or contract placed by the War Department or the Navy Department of the United States, or the United States Shipping Board Emergency Fleet Corporation, or by the Allies.

"Indirect government order" signifies materials, supplies or equipment necessary in the manufacture of or as component parts of direct government orders.

"Work of exceptional or national importance" shall be taken to mean work which, while not primarily designed for the prosecution of the war, yet is of great public interest and essential to the national welfare, such as equipment and supplies for railroads and other public utilities, equipment and tools for mining of fuel and ores required in war work, agricultural implements, food containers, repairs to existing industrial machinery, and any other work of similar character.

This form provides for a statement of close approximation of monthly purchase requirements in raw materials and supplies for all purposes and products on steel and iron, copper, brass, bronze, tin, babbitt, solder, mica, duck, other cotton products and oiled silks. The data are to cover:

Average monthly consumption over period of one year ending Dec. 31, 1917.

Average monthly consumption over period of six months ending June 30, 1918.

Stock on hand on first of month in which application is filed.

Estimated average monthly requirements for period of six months ending Dec. 31, 1918, having reference to voluntary curtailment as covered by separate pledges and increased demands for finished product for war.

There is an inquiry as to whether the applicant has the plant and equipment necessary and now available to execute all war orders upon which he is now engaged.

Provision is made for a record of all unfilled sales orders on hand or booked business which is unshipped as of first of month in which application is filed. This record must be exclusive of all orders for shipments to stock, to warehouses of applicant, on consignment, etc., and should include only bona fide sales. Where applicant feels that the information so supplied is not sufficiently representative of the character of his business, similar data may be submitted as a supplementary statement based on a close approximation of the business shipped during the two months prior to the first of the month under which the record of unfilled orders is filled. The sales values in dollars is to be used in arriving at percentages. This record is divided into the sales value in dollars of unfilled orders (per cent) and shipments during preceding two months (per cent) for the following classes:

1. Direct government orders.
2. Indirect government orders.
3. Work of exceptional or national importance (as defined in this application).
4. Orders from jobbers and dealers.
5. Orders for export on which export licenses have been issued by the War Trade Board: (a) To active allies; (b) to neutral countries.
6. All other work.

A record of the business done in dollars sales value, divided between booked or entered and shipped, is to be made for the year ended Dec. 31, 1917, and the six months ended June 30, 1918, on the same basis as that provided for the statement of raw-material requirements.

This is to be a sworn statement.

MONTHLY REPORT

Form P. C. 21, the monthly report of operation, states that the priorities committee will be guided by this report in considering the merits of the plant for continued supply of materials. Business booked is exclusive of all orders for shipment to stock, to warehouse of company reporting, consigned stock, etc., and must include only bona fide sales. Sales made during the month from products previously shipped to stock, consigned, etc., are to be included.

In compiling reports covering orders placed subsequent to Aug. 1, 1918, the term "work of exceptional or national importance" shall be taken to mean orders covered by Class B priority certificates or taking Class B automatic rating under Circular No. 4 of the priorities committee bearing date of July 1, 1918.

Sales orders booked are to be divided in dollars and per cent of total into the six classes shown for the record of sales under form P. C. 20.

This is also to be a sworn statement.

PROGRESS OF CALIFORNIA CO-OPERATIVE CAMPAIGN

Policy Adopted by the Advisory Committee Regarding Sales of Energy-Consuming Devices by Central Stations and Dealers

The advisory committee of the California Electrical Co-operative Campaign at its meeting in June adopted the following policy as to the sale of energy-consuming devices by central stations and dealers:

It is the policy of the advisory committee not to ask or urge central stations to go out of or to stay out of the business of selling lamps, appliances, etc., at retail to their regular consumers. It is, however, the policy to encourage the central stations to conduct their selling of appliances, etc., in a manner which shall conform to the business ethics of the retail merchants in whatever territory the central station shall conduct a retail merchandise business.

It is also the policy of the committee to help and encourage dealers to improve their business methods and so to serve the public in the retailing of lamps and appliances that a large volume of the business will naturally flow to them. This policy will be followed by the committee to the end that these two branches of the electrical industry may both profit to the greatest extent, and that the consumer may enjoy electrical service at the lowest cost consistent with the quality of the service.

The committee also arranged to issue and distribute a monthly bulletin which would carry to the contractor-dealers and other contributors information about the progress and plans of the campaign.

The committee accepted an invitation from the executive committe of the California Association of Electrical Contractors and Dealers to present the story and plan of the campaign at the evening meeting of the contractor-dealers' association, which is to be held in Oakland on July 27.

A get-together dinner for the central district of California is to be held in Fresno early in August.

NIAGARA POWER SUPPLY ENLISTED FOR THE WAR

War Department in an Official Statement Shows that Enlargement of Plants Will Provide Greater Facilities

An official statement bearing on the Niagara power situation has been issued by the War Department. Practically all the power available in the district is used to aid the prosecution of the war, direct war industries securing an average of 85.29 per cent of the total power of the two requisitioned companies, the Hydraulic Power Company and the Niagara Falls Power Company, and an average of 54.29 per cent of the total power of the co-operating companies. About 200,000 hp. additional could be absorbed by industries now operating. Some of this shortage will be relieved by the proposed enlargements of the steam plants of the Buffalo General Electric Company and the Niagara, Lockport & Ontario Power Company. Additions to these two plants will aggregate 62,000 hp. By means of a further development by the American hydroelectric companies at Niagara Falls their existing supply of power, amounting to about 250,000 hp., will be increased by about 160,000 hp. Co-operation to secure fuel supply for the steam plants in the district has been arranged with the Fuel Administration.

NEW CONSTRUCTION BEGUN AT NIAGARA FALLS, N. Y.

Addition to Hydraulic Power Company Plant Being Rushed to Make More Power Available for Essential Industries

Construction work has been started on an addition to the plant of the Hydraulic Power Company, Niagara Falls, N. Y. The work is being rushed at top speed so that 66,000 additional horsepower will be available soon. More than $1,000,000 will be spent on improvements and additions to the power plant immediately. The ultimate power development scheme will not be undertaken until legislation at Washington permits greater diversion of water at Niagara Falls.

The present construction work is the result of an agreement reached between representatives of the company and the War Department. The immediate necessity for more electric power for war industries in western New York aided in effecting a consolidation of the Niagara Falls Power Company and the Hydraulic company, and under the terms of the merger the Hydraulic company is to make immediate additions to power generating equipment so as to relieve the power shortage to some extent until permanent improvements can be made after the necessary legislation is enacted.

Present plans call for installation of two units of 33,000 hp. each. Ultimate development plans call for the installation of ten such units. With all the units in operation the plant will be capable of producing 450,000 hp. and would probably generate 400,000 hp., holding 50,000 hp. in reserve.

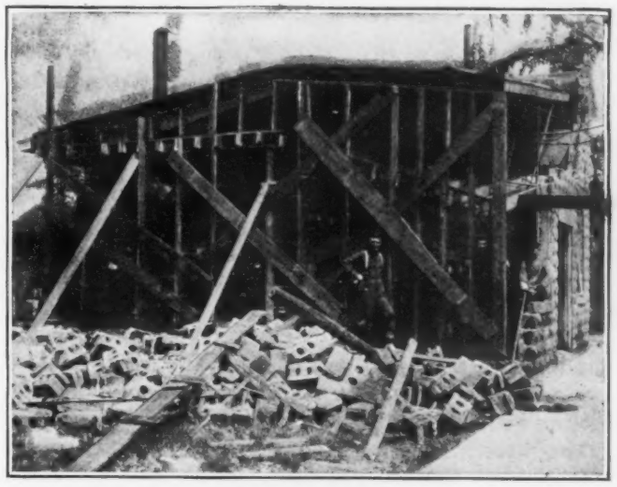
Contracts have been placed with the Great Lakes Dredge & Dock Company of Buffalo for dredging the power canal. The Allis-Chalmers Manufacturing Company, Milwaukee; General Electric Company, Schenectady, and the I. P. Morris Company, Philadelphia, have contracts for equipment. Delivery of waterwheels has been promised in seven months, and eight months is allowed for delivery of the generators.

With the installation of the two new units Niagara Falls will have the largest waterwheels and hydroelectric generators ever built. With the proposed battery of ten such units 330,000 additional horsepower will become available. The War Department is anxious to have the additional power available at the earliest possible moment. Even when the signing of the power merger bills by Governor Whitman of New York was still in doubt, the company patriotically agreed to the department's plans to award contracts immediately for the installation of two additional generating units.

WISCONSIN CYCLONE CARRIES STATION RECORDS 60 MILES

Storm Blows Out Wall of Electric Plant at Lone Rock, Demolishes Plant at Poynette and Interrupts Service at Madison for Two Hours

On the evening of May 21 a tornado struck two towns in southern Wisconsin and damaged the electric light plants in each place. The plant at Lone Rock, shown in the accompanying picture, had only one side and a few blocks on each end displaced by the storm, while the plant at Poynette was entirely demolished, there being only eight or ten concrete blocks left in place. At Lone Rock the storage battery was just inside of the wall which was blown down, but only one glass jar was broken. At Poynette the switchboard was carried out with the roof and some of the steam pipes were broken. Damage was done to the distribution system at each place, the total damage at Lone Rock being estimated at $1,000 and that at Poynette at $500. The plant at Lone Rock was started and furnished service to most of the town the following night, while Poynette was out of service for ten days.



20-KW. PLANT AT LONE ROCK (WIS.) AFTER THE TORNADO

Some of the station records from the Lone Rock plant were mailed back from Kingston, which is about 60 miles away. The cyclone put a short-circuit on both of the transmission lines from Prairie du Sac to Madison and thereby interrupted the service at Madison until the steam plant could be put on the line.

INDIANA COMMERCIAL MEN DISCUSS WAR-TIME PROBLEMS

Delegates from Twenty-two Central Stations Voice the General Sentiment Against Cessation of New-Business Activity

Methods of handling line extensions, the influence of the war on merchandising electrical goods, saving money on billing and collecting and selling lamps were the principal topics discussed before a meeting of the Commercial Section of the Indiana Electric Light Association at Indianapolis July 2. Twenty-two central-station companies were represented at the meeting, which was called primarily to discuss new problems confronting central-station sales departments. In an executive committee meeting of the Indiana Electric Light Association held at the same time it was decided to hold the regular annual convention at the Claypool Hotel, Indianapolis, on Aug. 7. This convention will be a one-day meeting.

R. Thurman of Muncie, who read a paper on "Methods of Supplying Service for Purposes Which Are Considered Essential," presented details of the methods most commonly used for financing extensions in Indiana. It appeared that the majority of companies, although not all of them, are passing on to the customers the extraordinary burden which making extensions at this time imposes.

J. D. A. Cross of the Edison Electric Appliance Company of Chicago pointed out the opportunity of using salesmen who formerly sold housewiring in selling energy-consuming devices to existing customers as a means of increasing central-station revenue without adding to capital account. O. M. Booker of Kokomo, speaking on "Distribution of Lighting and Power Statements and Collecting Customers' Accounts," told how Indiana companies are reducing expenses by having meter readers deliver bills. He urged greater attention to efficient collection of money. C. C. Perry of Indianapolis advised all electric light companies to retain control of the local incandescent-lamp situation and spoke against cutting lamp prices.

The discussion, directed by J. P. Ohmer of Elkhart, president of the Indiana Electric Light Association, brought out that there is a general sentiment against letting new-business departments go into decline. Many favored shifting the best men from the sales work to other departments temporarily. It was felt that salesmen should welcome this opportunity to get into other departments for the time being as the broader knowledge of the business they thus gain will be of real value later when direct sales work is resumed.

There was also some discussion of the advisability of association action on the matter of getting the daylight-saving law extended to cover the entire year. Such an extension would, of course, benefit nearly all electric light companies by increasing annual load factors and would benefit the government by making available power-producing apparatus which is now useful only a short time on the winter peak. This question will probably come up at the annual meeting of the state association. Some operators avowed their intention to endeavor to promulgate the idea in their own cities regardless of what national legislation may be passed on the question.

INCREASES IN RESIDENTIAL RATES GRANTED IN ILLINOIS

Commission Increases Rates for Lighting in Smaller Towns, Inserting in the Order a Refund Provision in Case Rates Prove Too High

The Public Utilities Commission of Illinois has passed several orders recently which are interesting. One order grants the Illinois Northern Utilities Company emergency relief as regards electric rates to the amount of 1 cent per kilowatt-hour for lighting purposes and some increase on the power rates. In that portion of the Illinois Northern Utilities Company's territory which was formerly operated by the Tri-County Light & Power Company in the vicinity of Aledo the commission authorized an increase of 1½ cents per kilowatt-hour on the lighting rates which were in excess of 10 cents per kilowatt-hour and 1 cent per kilowatt-hour on the rates which were less than 10 cents per kilowatt-hour. In both of these cases the order of the commission carried with it a refund provision if the commission should by subsequent investigation determine that the rates temporarily authorized were higher than the company should be permitted to ask.

The commission has also granted emergency relief to the Southern Illinois Light & Power Company, which operates in about twenty-five cities in the southern part of the state. This increase involves an increase in gas rates to $1.50 per 1000 cu.ft. and an increase of lighting rates of 1 cent per kilowatt-hour. This order also carries with it a similar refund provision. The Southern Illinois Light & Power Company subsequent to filing the application for the first increase, which is that mentioned above, filed an application for a further increase which for the lighting business will amount to perhaps 2½ cents per kilowatt-hour.

The Central Illinois Public Service Company is asking to increase its rates for electric lighting service by 1 cent per kilowatt-hour and to increase rates for street-lighting service by an amount of about 10 or 15 per cent. The commission is conducting an investigation in all of these cases at the present time, and its conclusions are awaited with considerable interest by the Illinois companies chiefly concerned.

HIGHER RATES ARE ALLOWED IN ST. LOUIS

Union Electric Light & Power Company Authorized by Missouri Commission to Add Flat Charge as Emergency Measure

The Missouri Public Service Commission has authorized the Union Electric Light & Power Company, St. Louis, to increase rates for large consumers of electrical energy as an emergency measure.

Holding that rates for energy in excess of 1000 kw. a month are unreasonably low, the commission authorized the company to add a flat charge to cover increased cost of coal, labor and taxes. The company, with the aid of the commission and a representative of the interveners, if they so desire, was directed to prescribe a charge to cover the increase in cost of labor and taxes for which the proposed charges are meant to apply along with a coal rider.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Right of Municipality to Exceed Contract.—An order of the district court requiring a public service corporation under a contract to furnish a municipal corporation with electricity for lighting for seventeen hours each day where the contract calls for about eleven hours' service exceeds the terms of the contract and is unauthorized, the Supreme Court of Minnesota held in Village of Clinton versus Ottertail Power Company (167 N. W., 794).

Death from Electric Shock.—In a widow's suit for damages because of her husband's death in service, he being killed by an electric current, natural or generated, when he went into a frame building on the premises of defendant, or was forced to take refuge therein from rain, the petition, which did not explain why defendant was responsible for the husband's being in the building at the time, though stating that the husband was in defendant's employ and that he had a right to be in the building, did not state a cause of action, according to the Supreme Court of Louisiana (78 S. 469).

Granting of Water Rights.—A deed to a city granting the exclusive right to appropriate water flowing into a river through certain described real estate, with right to enter upon such lands for constructing flumes and right to overflow same, conveys an easement and not title to the water itself, the Supreme Court of Washington held in City of Raymond versus Willapa Power Company (172 P. 1176). Where a deed conferring on a city the power to appropriate the waters of a river on a tract of land conveyed an easement merely, the owner of the servient estate may make such use of his estate as is not inconsistent with the easement. There can be title by prescription to a water right where there has been no adverse or hostile assertion of right.

Use of State Roads.—The law authorizing telegraph and telephone companies to construct lines, poles and conduits along roads without liability as for a nuisance does not place the State under any contractual or other obligation to permit a telephone company to use the highways without compensation, the Court of Appeals of Maryland held (103 A. 447). The State may exact compensation from telephone and telegraph companies for the use of the highways for erection of fixtures and telegraph lines. Where the state roads commission attempted without authority to impose a charge for permission to telephone company to use roads, but offered a permit without charge "without prejudice to its right in the future to collect a charge," the telephone company was not entitled to an injunction to restrain the imposition of a charge, since acceptance of such free permit with reservation would not have affected the company's right to object to the imposition of a charge at a future date if attempted.

Contract Obligations Arising from Franchise Rates.—Under the law providing that telephone companies shall obtain the consent of the City Council to construct and maintain city lines, the city may contract for a minimum monthly charge to users within the city as a condition for a franchise, according to the Supreme Court of Washington (172 P. 899). An accepted telephone franchise ordinance is a contract, and the company cannot destroy the right of persons residing in the city to the minimum service rate provided therein by declaring the provision abrogated so long as it operates thereunder. If the Public Service Commission can change the minimum rate to users of telephones as fixed by the franchise ordinance, the franchise rate must remain in effect until the commission has acted and cannot be terminated by the telephone company filing a schedule with the commission. An action to compel a telephone company to render service to plaintiff at the minimum rate provided in the franchise ordinance, where the commission has not acted, involves a contract and not the reasonableness of the rate, and plaintiff's remedy was in the courts and not in the Public Service Commission.

Damages from Permanent Dams.—Where a permanent dam is constructed the measure of damages from flooding is the difference between the market value of the flooded land before and immediately after the dam is constructed, the Supreme Court of Iowa held in Wapsipinicon Power Company versus Waterhouse (167 N. W. 623). Where a permanent dam was constructed without a license the cause of action for damages for flooding occurred immediately upon its construction and did not pass under a warranty deed executed before a proceeding to obtain a license was commenced, and the vendee was not entitled to damages. Although a vendee of land flooded by construction of a permanent dam without a license has no cause of action for damages, he is a necessary party to a proceeding by the owner of the dam to obtain a license. Where a permanent dam is constructed, causing damages to land, transactions showing waiver or settlement for damages are not within the statute of frauds and may be shown by parole evidence. Where land was permanently damaged by construction of a permanent dam, if a settlement of such damages was within the statute of frauds, a vendee of the land could not set up such statute to prevent the dam owners from proving a settlement with his vendor, not being a party to such transaction.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Engineers' Club of Harrisburg, Pa.—C. A. Emerson, Jr., was elected president and H. E. Moses secretary of the Engineers' Club of Harrisburg, Pa., for the ensuing year at a recent meeting.

San Francisco Electrical Development League.—At the June 26 meeting Sergeant Dick Schneider related personal experiences at the front. Charles K. Field, editor *Sunset Magazine*, spoke on the topic "Back of the Front."

Jovian Electric League, Los Angeles.—Robert Wagner discussed phases of the moving-picture business at the June 25 meeting of the league. Dr. George A. Damon acted as chairman of the day. This was the last meeting of the league for the summer months.

Empire State Gas and Electric Association.—It has been decided that the Empire State Gas and Electric Association will hold an annual convention at New York City on Oct. 10. A committee has been appointed to arrange the program, which will be announced in the ELECTRICAL WORLD at a later date. A nominating committee has also been appointed.

Jovian League Annual Convention.—It has been announced that the sixteenth annual convention of the Jovian Order will be held at Dallas, Tex., on Oct. 14, 15 and 16. The business at the convention will be a brief review of the progress of the order during the current year, its major effort being to plan constructively for the task ahead, particularly with relation to the part the order may play in winning the war.

Mississippi Power Company.—The High-Tension Club of the Mississippi Power Company held its annual banquet at the Hotel Iowa, Keokuk, recently. After the banquet Judge William Logan acted as the toastmaster and gave a very interesting and instructive talk on "The Early History of the Keokuk Development." C. W. Kellogg, manager of the Mississippi River Power Company, gave an address on the Hog Island shipyards.

Municipal Electrical Engineers of Ontario.—The first annual convention of the municipal electrical engineers of Ontario was held in Niagara Falls, Ont., recently. President E. B. Buchanan of London, Ont., commented on the appropriateness of meeting at a place where 5,000,000 hp. or 6,000,000 hp. is ready for harnessing. He spoke of Canada's power resources as unlimited, saying that, in addition to Niagara, hundreds of other streams are waiting to produce hundreds of thousands of horsepower.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

To Erect Largest Wireless Station.—The Marconi company is to erect the largest wireless station in the world near Buenos Aires, Argentina. Edward J. Nally, vice-president and general manager of the company, has just closed a contract for the installation.

Toledo Railways & Light Company Joint Section.—The monthly meeting of the joint company section of the Toledo Railways & Light Company and Associates was held in the Zenobia Building on June 28. No business was transacted, the meeting being purely a social one during which a vaudeville performance was given. No meetings of the section are to be held during July and August, but it is anticipated that outside social entertainment will be given in these months.

Regional Industrial Commission for New York.—The regional industrial commission for the New York metropolitan industrial zone, appointed to classify and co-ordinate productive plants under the direction of the War Industries Board, includes: John W. Lieb, New York Edison Company; Ray Palmer, New York & Queens Electric Light & Power Company; Chauncey B. Baldwin, Standard Underground Cable Company; W. D. Baldwin, Otis Elevator Company, and William Hamlin Childs, Barrett Company.

Syracuse Company Gives Publicity to N. E. L. A. Resolution.—The "Carry the war to victory" resolution passed at the National Electric Light Association convention at Atlantic City in June and reported in the ELECTRICAL WORLD in the June 15 issue, page 1252, has been made the basis of a half-page advertisement in the local papers by the Syracuse (N. Y.) Lighting Company. After printing the resolution the company states that it was unanimously adopted at the convention and that the manager of the company "hereby expresses unqualified indorsement of the sentiments contained in this resolution."

Lignite for Fuel in Texas.—Converting lignite coal into a fine powder and feeding the particles under boilers in much the same manner as that in which crude oil is now handled for fuel may be put to practical and extensive use in Texas, according to plans of large industrial interests that have been conducting extensive experiments along this line for the past several months. It is stated that the work of pulverizing lignite and spraying the powder under boilers can be successfully and economically done. It is reported that the Texas Power & Light Company of Dallas has under consideration the construction of one or more large electric power plants at the lignite beds of that section of the state for the purpose of utilizing the new method of using that fuel in the generating of electric energy.

Power Plant Economy Clubs in Toledo.—At the Detroit Avenue station of the Toledo (Ohio) Railways & Light Company a club has been organized among employees which is named the Economy Club. The organization is an educational one, and addresses are given before the meetings on the method of operation and construction of boiler-room apparatus. For the same purpose in another station the Water Street Boiler Room Club has been started. A question box is maintained in this plant, and an extensive circulating library of manufactured catalogs and power-plant literature is being collected.

Unusual Electrical Storms in California.—Two severe electrical storms occurred recently in California, causing considerable damage, chiefly by fire. Weather Bureau records show these to have been the heaviest electrical storms in thirty years. One in northern California in the latter part of June started numerous forest fires and slightly damaged equipment on the lines of the California-Oregon Power Company. On July 1 a more destructive storm in southern California continued for more than twelve hours, causing damage estimated to total $250,000. Two 55,000-gal. oil tanks at El Segundo were destroyed and their contents scattered and ignited. Damage to Los Angeles electric systems was slight, and where interruptions occurred service was quickly restored. At Pasadena the precipitation for the storm was 0.41 in.

Missouri Association Advertises Need for More Revenue.—To appraise people all over the state of the situation which makes higher utility rates necessary the Missouri Association of Public Utlities is sending to its members already-prepared advertisements for insertion in local papers. The advertisements were written as a series by an association committee appointed for the purpose. The first series contained seven advertisements which it is planned to run weekly. Secretary F. D. Beardslee of St. Louis in a letter accompanying one of these advertisements said: "We know you realize the seriousness of the situation pertaining to utilities and the absolute necessity of speedy relief to hold the companies of this class of industry solvent. We trust you realize that for the utilities to procure the relief needed quickly it is necessary that each of us be perfectly frank and plain in laying the facts of our condition before our patrons and the general public, in order to prevent long-drawn-out disputes when our cases are taken up by the Public Utilities Commission. It is likewise of great value to advise our respective communities of relief procured in different communities and states other than our own, as evidenced by the many recent decisions rendered."

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Non-Utility Business.—The Illinois Public Utilities Commission, in authorizing increased electric rates for the Saline Electric Company, Du Quoin, remarked that where a public utility operates a non-utility ice plant it will not be permitted to make up losses in the utility business from the revenue of the ice plant nor losses arising in the non-utility business from revenue which is derived from the utility service.

Apportionment of Line Construction Expense.—Deciding a question as to the apportionment of expense for line reconstruction in a case affecting the Richland Light & Power Company and the Richland Telephone Company, the Missouri Public Service Commission holds that under a stipulation to abide by the decision of this commission as to the apportionment of expenses incurred in the reconstruction of electric and telephone lines occasioned by their close proximity the slight expenses incident to the individual alterations are assigned to the utility which could most easily and economically make the change or which would be benefited most thereby, irrespective of any rights of priority.

Re-rendering Bills.—The New York Public Service Commission, First District, has rendered a decision in the matter of the complaint of Charles A. Gould against the New York Edison Company with respect to its alleged refusal to re-render bills on the basis of a combination contract price instead of individual contract prices. The complainant alleged overcharge by the company for energy billed on separate meter readings of the tenants of the complainant which included a period from March 20, 1917, when an application for a master meter was made, to May 7, 1917, the date of the installation of the master meter. The commission held that the respondent is chargeable with undue delay in the installation of the master meter, that in the adjustment of similar complaints the company's own determination of whether there has been neglect or delay may lead to unjust discrimination, and that a general regulation should be adopted so as to provide that upon proper application for a master meter the wholesale rate for energy should apply after a specified number of days from the filing of the application. While the commission is without power to order reparation in the premises, it is suggested that the wholesale rate be applied to energy consumed in the building of the complainant between April 5 and May 7, 1917.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Charles Sessions has succeeded ex-Senator Joseph H. Bristow on the Kansas Public Utilities Commission.

R. C. Coffy, manager of the Sapulpa Electric Company, Sapulpa, Okla., was chairman of a committee which conducted a Red Cross auction sale and street dance June 22, netting $6,000.

Riece Ridgely has been appointed superintendent of the Arkansas Valley Railway, Light & Power Company at Ordway, succeeding H. H. Lyons, who has entered the government service.

J. M. Atkinson, resident manager for the Big Horn Light & Power Company, Worland, Wyo., has resigned to become manager of the Missouri Valley Light & Power Company at El Dorado Springs, Mo.

M. W. Birkett has been promoted by the Washington Water Power Company, Spokane, Wash., from assistant superintendent of light and power to assistant to the general manager of the company.

George W. Hardy has been appointed superintendent of the distribution department of the Worcester (Mass.) Electric Light Company, with headquarters at 166 Faraday Street, succeeding L. M. Haight, resigned.

C. C. Lovejoy, who was formerly associated with the Illinois Electric Company and the Geyser Electric Company of Chicago, has been appointed new-business manager of the Fort Smith (Ark.) Light & Traction Company.

John Moles, formerly emergency foreman and engineer on the staff of the General Electric Company, with headquarters at Schenectady, N. Y., and Erie, Pa., has succeeded John W. Brassington as chief engineer of the American Writing Paper Company, Holyoke, Mass.

C. L. Jacklett has been transferred from the position of district manager for the Pacific Power & Light Company at Prosser to be district manager at Toppenish, Wash., succeeding G. T. Drenna, who is on leave of absence. Mr. Jacklett has been at Prosser since the fall of 1917.

John W. Hallowell, who has been with Stone & Webster since 1901 and a member of the firm since 1912, has retired from the firm. Since May, 1917, he has been in Washington as a member of the Food Administration, and he expects to continue in that work for the duration of the war.

Walter Wellman has been appointed assistant engineer in the Wisconsin State Engineering Department and assigned to the service department of the Railroad Commission. Mr. Wellman has been in the distribution and engineering department of the Madison (Wis.) Gas & Electric Company for the past seven years.

Herman Gamper of Columbus, Ohio, has been appointed power engineer of the Emergency Fleet Corporation. He has been engaged in making a physical valuation of the light and power properties of the Columbus (Ohio) Railway, Power & Light Company for the city of Columbus. He will be stationed at Philadelphia, but will return occasionally to continue his appraisal work on the Columbus properties.

Paul B. Findley, technical editor in the department of publicity, Westinghouse Electric & Manufacturing Company, has resigned to enter the training school at the University of Pittsburgh, where he will take a special course in radio work with the Signal Corps. Before joining the Westinghouse Electric Company, Mr. Findley was editor of the *Electrical Age*.

J. L. White has resigned as manager of the Albany office of the Oregon Power Company to go into business for himself in Seattle. For several years he was manager of the company's Dallas office. He was transferred to Albany in the spring of 1914. In the fall of 1916 he was appointed manager of the Willamette Valley division.

Dwight P. Robinson has retired from the firm of Stone & Webster, of which he has been a member since 1912. He first became connected with the organization in 1893, and in 1908 he was elected president of the Stone & Webster Engineering Corporation. Mr. Robinson was born in 1869. He was graduated from Harvard with the degree of A. B. in 1890, and two years later with the degree of B. S. from the Massachusetts Institute of Technology.

E. A. Wilcox, formerly manager of the Public Service Company of Oklahoma, Tulsa, Okla., has resigned to accept a position in the power and light division of the Fuel Administration at Washington. Prior to his connection with the Public Service Company of Oklahoma, Mr. Wilcox became well known through his connection with the new-business departments of Pacific Coast companies and through the publication of a book on electric ranges.

Dr. Miller Reese Hutchinson, for a number of years chief engineer for Thomas A. Edison and more recently handling the sale of Edison storage batteries to the government, operating under the name of Miller Reese Hutchinson, Inc., has resigned from the Edison interests to devote his entire time to his duties on the Naval Consulting Board, of which he has been a member since the fall of 1915, and to other government work. Dr. Hutchinson, who is forty-one years old, was graduated from the Alabama Polytechnic Institute in 1897 and during the Spanish-American War was chief engineer of the seventh and eighth districts of the United States Lighthouse Service, engaged in laying submarine cables and mines along the South Atlantic coast.

Carl F. Uhden has resigned as chief engineer of the Washington Water Power Company, Spokane, Wash.

Fred Brown of the Tacoma Gas Company has been appointed to succeed H. A. Joslin as manager of the Eugene office of the Oregon Power Company.

V. H. Greisser, formerly electrical engineer for the Washington Water Power Company, Spokane, Wash., is now consulting engineer for the company.

D. H. Henderson has been advanced from assistant superintendent of distribution to superintendent of distribution of the Washington Water Power Company, Spokane, Wash.

B. M. Merrill has been advanced from assistant superintendent of power to superintendent of power of the Washington Water Power Company, Spokane, Wash.

R. U. Steelquist has been transferred from the post of manager of Dallas, Ore., to be manager at Albany for the Oregon Power Company, succeeding J. L. White. Mr. Steelquist has been manager at Dallas for the past two years, having been manager for two years prior to that at Corvallis.

Clifford S. MacCalla has resigned as vice-president and general manager of the Washington Water Power Company, Spokane, Wash. Mr. MacCalla has been with the company for the last fifteen or sixteen years. He has been general manager for the past seven and a half years. Prior to his connection with this company he was engaged by the General Electric Company in railway work in Australia and later by the Edison Electric Illuminating Company of Brooklyn, N. Y.

Prof. James E. Ives, physicist, research associate and lecturer at Clark University, Worcester, Mass., has been commissioned first lieutenant in the Signal Reserve Corps. Lieutenant Ives was born in London, England, in 1865, and was educated at Harvard, the University of Pennsylvania and Clark University, receiving the degree of Ph. D. from the last-named institution in 1901. In 1904 he was awarded a silver medal at the St. Louis Exposition for his work in radio-telegraphy. He is a fellow of the American Academy of Arts and Sciences and the Institute of Radio Engineers, a member of the Academy of Natural Sciences, American Physical Society and Société Francais de Physique, and has written extensively on scientific subjects. He has been requested to take up special radio investigations for the government.

Obituary

Charles L. Redding, superintendent of the Whitman (Mass.) electric lighting department and of the electrical department of the State Farm, Bridgewater, Mass., died recently at Brockton, Mass., at the age of forty-one.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

RUBBER REQUIREMENTS ALLOCATED ON WAR BASIS

Electrical Industry Will Operate on Seven-sixteenths Usual Consumption for Civilian Orders— Ample Stocks of Crude

Uneasiness is being expressed in certain quarters for fear that a shortage of crude rubber is imminent. On this score anxiety is reported on the part of wire and cable manufacturers. So far as can be ascertained from reliable sources, there is really no need for concern. The importation of crude rubber in 1917 was 196,000 tons. On May 1 the government restricted the importation of crude at first to 25,000 tons for three months. This period expires July 31. It is now learned that the War Trade Board has continued the restriction for a year, and, according to the secretary of the committee on rubber and kindred products, working under the direction of the United States government, it will be continued indefinitely or for the duration of the war. This means the annual importation of 100,000 tons of crude.

It is estimated by the War Trade Board that the government's requirements will be 35,000 tons. The remainder is to be allocated for manufacturing uses of a civilian nature. The electrical industry will have its needs supplied on a basis of seven-sixteenths, or 45 per cent, of its 1917 consumption. On war or government orders the allotment will be 100 per cent.

Free rubber is difficult to obtain in the open market, according to an official statement. Wire and cable manufacturers, on the other hand, say the stock of rubber now in the country is ample for the electrical trade at least and that its wants will not be curtailed. Some industries of the less essential class are to have their demands sharply cut down. As previously quoted the price of standard quality smoked sheets is officially fixed at 62 cents a pound; first latex crêpe, 63 cents; fine up-river Para, 68 cents. On May 14 the board also named prices for forty other grades of rubber, and those in which the insulated-wire trade is most likely to be interested are as follows: Up-river medium, 63 cents a pound; islands fine, 59 cents; prime lighthouse crêpe, 60 cents.

PRIORITY FOR COOKING APPARATUS IN ENGLAND

Necessity for Large Industrial Kitchens Leads Ministry of Munitions to Provide Raw Material for Cooking Apparatus

In England difficulty exists in obtaining delivery of suitable cooking apparatus for public kitchens, regardless of whether the appliances are heated by coal, gas or electricity. Most manufacturers have their hands full in meeting the requirements for equipment needed in factory canteens and large industrial installations aside from the requirements of national kitchens. According to the *Electrical Times*, this situation was recently called to the attention of the Ministry of Foods during a meeting in the House of Commons, and the suggestion was made that a more favorable priority be granted to the manufacturers of cooking apparatus. The reply indicated that such action had already been taken.

In discussing this situation the *Electrical Times* points out that even if sufficient quantities of raw material and skilled labor are provided, considerable time will be required to manufacture the cooking apparatus which is needed immediately. In this connection the paper expresses its regret that assistance from the United States is not asked, pointing out that several electric heating manufacturers in this country would be able to make immediate shipments of cooking apparatus for serving large numbers of people. If a temporary special license were granted for the exploitation of such equipment as this to England, it should be an opportunity for driving an entering wedge that would be useful in after-the-war trade—one that manufacturers of electric heating equipment could not afford to neglect.

EFFECT OF COPPER ADVANCE ON THE ELECTRICAL MARKET

Wire and Brass Increase in Price—Other Articles May Follow According to Relative Amount of Copper Used

Somewhat as a surprise came the increase in official price of copper from 23½ cents to 26 cents. Already its effects are being experienced in the electrical line. Wire, always the first material to feel the fluctuations in the price of copper, advanced accordingly. Rubber-covered wire base advanced from 30 to 34 cents, weatherproof to 32 cents. Lamp cord and annunciator wire have also advanced.

Brass has increased as a result of the rise in copper at least 2 cents a pound where quotations are being made. The settlement of labor disturbances, anticipated shortly, is expected to make for steadier prices in brass.

Copper and brass enter into the make-up of many electrical commodities. The effect, however, will probably be proportionate to the amount of the materials used. Thus where but a small amount is used and the proportion of the expense of this material to the total cost of manufacture is small there is little reason to expect an advance in the price of the finished article, unless this is the culmination of a series of higher costs which on the whole necessitate a wider margin of profit.

A number of items of electrical fittings using both copper and brass in a limited degree have advanced within the past few weeks, and it is rather doubtful if these will go any higher as a result of the government's action. The manufacturers, it is known, are well supplied with 23½-cent copper.

On the other hand, there are a number of articles on which the increased cost of copper and brass will make an appreciably increased cost of production, such as motors, generators, transformers, knife switches, desk portables, controllers, brass connectors, bushings, nipples, brackets and tubes, ceiling and wall fixtures, cable connectors and others.

A number of these items have yet to raise their price to take care of the recent advance in freight rates. It would not be surprising, therefore, to see many more advances in price than have been experienced in the past few weeks.

Furthermore, there are no indications that copper may not go higher, even to 30 cents, in another month. The present price of 26 cents, which it is well known is by no means satisfactory to producers, is made only until Aug. 15. Prior to that time two meetings are scheduled between the War Industries Board and the copper producers.

THE WEEK
IN TRADE

SHARP advances in the cost and in the difficulty of obtaining raw material, the 25 per cent advance in freight rates, the shortage and high price of labor and the increase in the price of copper have had their logical effect on every line of electrical apparatus, staple merchandise and specialties. Higher price levels are now prevalent in every section of the country, and the readjustments in connection therewith are uppermost in all transactions in the purchase or sale of goods. The Department of Labor on Monday issued its regulations governing the employment of unskilled workers in concerns having 100 men, effective Aug. 1.

The change in the official price of copper led to an immediate revision of prices in covered wire, cable and other articles of which the metal is a part. The stock of conduit is low and the supply contracted. In the Pacific Northwest shortages still prevail in certain sizes of wire, larger types of lamps and larger motors. Small motors up to 25-hp. rating are easier in New England, with orders being filled out of stock. On this class of motors the production is running behind in the Middle West. An advance of 10 per cent on some types of lamps was made July 1, applicable in all sections.

NEW YORK

A close survey of the market inevitably leads to the conclusion that price regulations and readjustments are matters of the most concern to the trade. The manufacturers making the revisions announce the changes with little if any formality or explanation beyond the fact, understood and intelligible to everybody in interest, that material for commercial work is getting more difficult to obtain. In fact, certain items require priority.

Traffic conditions have improved in this territory under governmental management. The rail congestion has been relieved appreciably, according to the heaviest shippers. Water transportation is also greatly improved.

Business is prosperous in a high degree, the volume of trade being greater than in the preceding week, with government orders largely in the ascendant. Collections are held firmly to a thirty-day basis, with efforts to reduce sales as far as possible to the two-off ten-day class. Instances are given where only 1 per cent is allowed.

POLES.—As poles are sold f.o.b. delivered, in accordance with the recent 25 per cent advance in freights, prices will be higher in proportion. White and red cedar are in fair supply. Chestnut in lots of 1000 is not easy to negotiate on the Eastern seaboard. Smaller lots are in a better position.

FARM-LIGHTING OUTFITS.—Higher freight charges and increased cost of material will cause an advance in price by an Eastern manufacturer next month of from 10 to 15 per cent. Two Western manufacturers have already increased the selling cost of their outfits.

ELECTRIC CONTROLLING DEVICES.—An advance of 10 per cent, effective July 1, was made by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis. In making the announcement the company says: "The constant increase in cost of labor and material makes it necessary for us to increase our price by a change in discounts. We will, however, protect for a period of thirty days bona fide outstanding quotations made prior to July 1, and will protect quotations made by us thirty days from date of such quotations." The discount of the company applies only to bulletins dated March, 1916, or later, and all prior bulletins are canceled. A half dozen other manufacturers in the same line have made a like discount available.

POLE HARDWARE.—While there is no change in price, the government steel requirements will restrict the output of pole hardware in the next six months to a marked degree. There is some feeling that this may have a tendency toward higher prices. There is no heavy demand beyond government needs. With the new official policy of expanding Western industrial activities the best market for this line will be shifted from the East.

FRACTIONAL MOTORS.—On sewing-machine direct-current motors of from 1/32-hp. to 5-hp. rating an increase in price of 5 per cent went into effect June 1. In March a 10 per cent advance was made. Deliveries locally are made in ten days.

FANS.—Jobbers' stocks are low. In fact, some concerns are completely sold out, two cars arriving for account of one firm going out at once, with another car to arrive sold in advance. One large manufacturer is said to have been cleaned out a month ago. Both 12-in. and 14-in. alternating-current and direct-current oscillating type are reported as not to be had. There is no reserve stock to draw upon in this section.

BARE AND COVERED WIRE.—All manufacturers of bare and covered wire increased the base price following the higher cost of copper made by the government. On rubber-covered the base was immediately placed at 34 cents, and the price for that class of goods will range from 26 cents to 34 cents a pound, according to the importance of the order. One cable manufacturer withdrew all prices on July 3 and will accept orders only up to Aug. 15 at 26 cents. Previously to that date his prices were for immediate acceptance. A readjustment of copper wire and cable prices is under way or has been sent to the trade. The change came as a surprise. Deliveries are from six to eight weeks on commercial orders. Wire and cable manufacturers, though engaged heavily in the production of government necessities, are also taking care of the requirements of the regular trade to the best of their ability.

CONDUIT.—Manufacturers issued a notice that on June 25 the price of conduit would be raised two points—about 5 per cent. To this the new freight rate of 25 per cent must be added to all points, as conduit is sold f.o.b. mill. Distributers have passed along the differential to the trade, making a 5 per cent increase from local warehouse, with freight additional when shipped by rail. This went into effect on the same date. This is general, although the distributers believe they are entitled to a higher figure to cover the cost of handling. Stocks are low in all sizes, particularly the large sizes. There is no free pipe in the market. The mills are running strong on 3½-in. conduit—the government specifications—as against ½-in. and ¾-in. pipe for commercial uses.

LAMPS.—Miniature and "gem" lamps are advanced 10 per cent on July 1.

CROSS-ARMS.—Stocks in the East are stronger, with the mills working only on a 50 per cent basis. The recent increase in price is between 4 and 5 per cent.

CHICAGO

A partial summary of jobbing conditions in the Chicago territory indicates that the volume of business for the first six months of 1918 has been entirely satisfactory. The expense of doing business, however, has increased to such an extent that profits among the jobbers are not so satisfactory. The jobbers have been doing practically the same volume of business as last year, and the increase in expense of doing business is reported to be 25 per cent in some instances. Another reason why profits have not been up to standard with the jobbers is because a considerable volume of government business has been done, and this has been taken on a very narrow margin.

The price trend, which flattened out somewhat after the recent increase in freight rates, was given another sharp upward tilt by the increase in the government price of copper from 23½ cents to 26 cents. Following this announcement prices of all wire products increased. Price standards were also marked up on other lines in which

copper is included. It now appears that the price increases which followed the first advance amount on the average to a little more than 25 per cent of the usual freight cost, the general policy being to mark up the price to an extent which would permit the same margin of profit to be secured as was made formerly. Price changes have been announced by the Benjamin Electric & Manufacturing Company, the Square D Company, the George Cutter Company and by other concerns which make pole-line hardware.

COPPER WIRE.—Lamp cord, magnetic wire, all cable and bare wire have increased in price subsequent to the announcement that the government price of copper had increased from 23½ cents to 26 cents. The Chicago base on weatherproof wire is now 32 cents, and the base on rubber-covered wire is at 33 cents to 34 cents.

SCHEDULE MATERIAL.—There has been some slight readjustment of prices on schedule material in the Chicago market. Some jobbers believed they were selling their stock too cheap and so increased the price a trifle. The tendency on this class of goods is for prices to increase.

DOMESTIC APPLIANCES.—Excellent business is reported in all lines of domestic appliances, including the larger apparatus, such as washing machines.

FANS.—The Chicago jobbers have not yet begun to move their fan stock, owing to the fact that the weather has not been such as to create a demand for fans. In the Southwest it is reported that jobbers have been sold out on fans once and have replenished the stock.

MOTORS.—The Chicago market for motors of ordinary sizes continues to be active. There still is difficulty in building up motor stock.

SMALL MOTORS.—One Middle Western manufacturing concern reports that it is 40,000 small motors behind.

BOSTON

The volume of trade is being maintained at war levels, and the arrival of the vacation period has so far had little effect upon sales. The buying activities of the government continue to dominate the market and it is getting harder and harder to obtain supplies for ordinary commercial use. Deliveries are improving somewhat, but this is apparently due to the intensive production found at the factories, which in some cases is yielding equipment and supplies for stock shipments. Railroad congestion shows little improvement, the shortage of motive power and labor being serious. It looks as though embargoes would be the rule for some time. Prices remain about the same as last week, barring increases in wire, miniature and "gem" lamps as outlined below. Collections vary in quality, some jobbers reporting very good credit conditions and others rather unsatisfactory settlements. Stocks of appliances are large.

MOTORS.—Small motors, up to to 25 hp. rating, are now fairly plentiful, and orders are frequently being filled from stock. The larger sizes are in stock in some cases, but are somewhat irregularly located.

WIRE AND CABLE.—Wire advanced on July 3 from a 30-cent base to a 34-cent base, following the increase in the base price of ingot copper from 23.5 cents to 26 cents per pound. Weatherproof is now quoted at 32 cents, slow-burning at 32.5 cents, rubber-covered at 33 cents, and bare copper wire at 29.5 cents. The market is active for sizes used in shipbuilding, and deliveries are rather slow on the larger cross-sections.

LAMPS.—Stocks are increasing as the result of vigorous factory work. The central stations are now well supplied, the consumption at this season, of course, being a favorable factor to the accumulation of reserves. There is no question that the demand for lamps has decreased because of the daylight-saving program. Miniature lamps are still short, owing to the enormous government demand. On July 1 an advance of about 10 per cent took effect in both miniature and "gem" types.

FUSES.—The demand is very large, especially for industrial uses. Factory stocks are low and insulating materials hard to obtain.

FANS.—The protracted cool weather is beginning to cause anxiety among retailers and jobbers, who are carrying large stocks.

INDUSTRIAL HEATING EQUIPMENT.—A good deal of quiet development work along lines related to war industry service is being done in New England. This should materialize in the near future in applications of wide market interest.

CONDUIT.—Spasmodic arrivals of pipe are a feature of the market. One Rhode Island jobber has just received a carload of conduit ordered fifteen months ago, and long deliveries are no exception in other cases. Stocks are spotty, and priority orders dominate the situation.

FLASHLAMPS.—A moderate sale is reported to American soldiers in France through the Paris purchasing bureaus of merchants in this country. The domestic product continues to be sold in large quantities for cantonment and other service here.

ATLANTA

Business in all lines is well sustained this week. The volume of sales covering staple and schedule material continues heavy. The greater portion of the demand appears to be coming from government and quasi-government quarters. Replies to all inquiries from jobbers indicate that normal commercial channels of trade are being further subordinated to government requirements.

Activity in textile construction and associated lines continues in the Carolinas. The American Process Company of Mount Holly, N. C., contemplates the erection of a mill for bleaching, mercerizing and dyeing.

The Mays Manufacturing Company of Lexington, N. C., has been incorporated for $2,500,000 to manufacture adding machines. Indicative of further progress in shipbuilding is the establishment of a million-dollar steel-ship fabricating plant at Birmingham, Ala.

PANELBOARDS AND CABINETS.—For a time sales have been sagging, but manufacturers state that the outlook this week is much brighter. Deliveries remain about the same. The Emergency Fleet Corporation has placed a substantial order for pilot-house panel control to be used on wooden ships being built at Southeastern coastal cities.

CONDUIT.—Reports from Jacksonville, Fla., Birmingham, Ala., and Nashville, Tenn., are to the effect that conduit stocks have become almost depleted, the only stock of any size being at New Orleans, La., which is about 25 per cent below normal. The government requirements at this point were taken care of by shipments direct from the East. While the call from commercial channels has fallen off, a number of inquiries are being made in the face of present conditions. The demand for flexible and armored cable has increased with a corresponding advance in price.

FANS.—The movement of fans in all sizes has been very satisfactory this week, with the exception of the last few days, which registered much lower temperatures. A few jobbers have been disappointed this season by the non-delivery of their fan quotas.

WIRE.—The withdrawal of prices on all wires makes for considerable uncertainty regarding the future.

HARDWARE.—Except for the sustained government demand, the volume of transactions is off. Deliveries are poor and about twice as long as one month ago.

METERS.—Sales would indicate that the call for the residential type has shown a little improvement.

LABOR-SAVING DEVICES.—Jobbers and retailers are doing a good business in all the popular appliances, especially washing machines. Shipments are good.

HEAT CONTROL.—A practically new device for regulating furnace draft has had a heavy sale this week. One retailer has sold over the counter approximately seventy of these appliances in the last few days. There is a virgin field lying open for this type of appliance, and a big business should be done this year. Shipments are fine.

SEATTLE

Wholesalers report a gratifying volume of sales and inquiries in considerable numbers which presaged satisfactory business for the coming months. During the past week domestic appliances particularly moved rapidly. However, wholesalers report a shortage along these lines which shows no intimation of improvement. A shortage of certain sizes of wire, large size lamps, larger size motors, conduit, etc., still exists with no hope of betterment. The volume of sales of schedule material, including wire and conduit, to shipyards and industrials is heavy. Jobbers are embarrassed by shortages and dilatory freight movements. A slight increase in the price of wire is noted.

The freight situation has not been relieved and is expected to grow much worse when the crop movement begins. Inquiries for a considerable amount of power apparatus have been received. The labor shortage along all lines is increasing, owing to enlistments and draft operations.

The housing division of the Department of Labor will expend $500,000 in Seattle this year in housing employees of the Skinner & Eddy Corporation. The anticipated fall rush of war industrial workers to Seattle has begun, and everything possible is being done to stimulate building activity to care further for the rapidly increasing population.

Contracts for steel, wooden and concrete vessels in the various shipyards in the Puget Sound and Columbia River districts feature the week's industrial news. The Puget Sound navy yard is instructed by the government to proceed with the construction of a two-and-a-half-million-dollar ammunition ship and seven mine sweepers, involving several million dollars. The Seattle wooden shipbuilding plant has secured a contract for five additional 5000-ton wooden ships. The Everett concrete plant has secured contracts of $2,000,000 for concrete ships. The Vancouver (Wash.) yard has been given contracts for four 3500-ton wooden craft, and the yards at Tillamook and Astoria, Ore., have contracts for one wooden vessel each.

AUTOMOBILE LAMPS AND STORAGE BATTERIES.—Sales show a slight increase, particularly on lamps. Stocks on these commodities are low. Prices remain steady.

ELECTRIC WELDING APPARATUS.—Inquiries and sales for shipyard and allied industrial plants are noted. However, the utilization of this equipment in the Northwest is not general.

WIRING DEVICES.—Owing to the increasing amount of small residence construction dealers report good sales. Considering demand and freight conditions, stocks are in fair shape. The fluctuations in prices have been negligible.

LIGHTING FIXTURES.—Sales to home builders are very satisfactory and to industrials considerably heavier than last year and are increasing.

SAN FRANCISCO

In looking over the records of recent building one notes the absence of the factory and industrial work so prevalent since the first of the year and its replacement by dwelling and cottage building. Most of this is for industrial help. This seems to show that from now on electrical industrial work will be more along the lines of maintenance than of new construction. On the other hand, a lot of the new building previously announced is about ready to begin in earnest, so that although future records will not show the great quantity of electrical construction material that is to be used, yet large sales will be the rule for months.

Two irrigation projects of considerable size are under consideration, one providing for the watering of an area of 15,000 acres in the vicinity of Lindsay. The other covers an area of approximately 30,000 acres in the vicinity of Croville and incidentally provides for taking over the South Feather Land & Water Company power system. It is proposed to spend nearly $80,000 in extensions, repairs and replacements to the system of the Hawaiian Telephone Company of Hilo.

The 25 per cent increase in transcontinental freight rates, effective June 25, and the greatly increased traveling rates are responsible for a general change in f.o.b. Pacific Coast prices, varying from 10 to 25 per cent. Some items, such as schedule material, have advanced several times. Besides those items which are treated at greater length below, the following lines have recently changed in price: Fiber and insulating material, connectors, oiled cloth, lamp guards, reflectors and flexible non-metallic conduit.

GLASS INSULATORS.—The great weight of glass insulators and the sharp advance in freight rates makes necessary a 10 per cent increase in selling prices, effective July 1. The demand is poor on account of little extension work, and local stocks are topping.

TAPE.—In addition to a 10 per cent advance in high-grade friction tape a further advance of approximately 20 per cent in commercial friction tape became effective July 1.

METAL MOLDINGS AND FITTINGS.—Metal moldings and fittings have advanced 20 per cent, and further advances are not unlikely in the view of the practical commandeering of the steel industry for government service. Greater familiarity with their possibilities and the efforts of competing lines have intensified their sale.

WEATHERPROOF WIRE.—After a comparatively long period of price inactivity this fickle commodity has just changed, the new price being a decrease of more than 6 cents a pound in maximum quantities over the previous prices.

METAL MARKET SITUATION

War Industries Board Raises the Price of Copper—Lead and Spelter Continue to Advance

Since last week an entire change has occurred in the copper situation. Much to the surprise even of those supposed to have inside information, the War Industries Board through its price-fixing committee allowed an increase of 2½ cents a pound on July 2 to go into effect at once. The President approved the agreement the following day. Instead of 23.50 cents a pound, the official price in carloads or over is now 26 cents, and in less than car lots, or what is known as the jobber's price for smaller consumers, the selling figure will be 27.30 cents a pound. This price is to remain in effect until Aug. 15.

Lead continues to advance, and while 8 cents a pound was reached in last week's quotations, manufacturers are making a base price of 9 cents a pound this week. Tin rules about the same as last week, but the War Industries Board has issued specific instructions for its use in manufacturing which apply to the electrical trade as well as other industries. Spelter is also showing more firmness. Such fluctuations as appear in the old metals are a stiffening in heavy lead and old zinc scrap.

NEW YORK METAL MARKET PRICES

	July 1	July 8
Copper:	£ s d	£ s d
London, standard spot	110 0 0	110 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 26.00	Govt. price 26.00
Electrolytic	Govt. price 26.00	Govt. price 26.00
Casting	Govt. price 26.00	Govt. price 26.00
Wire base	28.25	30.00
Lead, trust price	8.00	9.00
Antimony	13.00 to 13.25	13.00 to 13.37½
Nickel, ingot	40.00	40.00
Sheet zinc, f.o.b., smelter	Govt. price 15.00	Govt. price 15.00
Spelter, spot	8.80 to 8.90	8.90 to 9.00
Tin, Chin se*	90	$1.00
Aluminum, 98 to 99 per cent	Govt. price †33.00	Govt. price 33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper wire	21.50 to 22.00	23.00 to 23.50
Brass, heavy	13.50 to 13.75	14.00 to 14.50
Brass, light	10.50 to 11.50	12.00 to 12.25
Lead, heavy	7.12½ to 7.37½	7.12½ to 7.50
Zinc, old scrap	6.50 to 6.75	6.50 to 6.75

* No Straits offering. † In 50-ton lots or more; carload, 33.10 cents per lb.; 1-ton to 14-ton lots, 33.20 cents per lb.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List Per 1000 ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List to + 15%
Coil to 1000 ft	10% to 57.25
	No. 12 Solid
Less than coil	List to + 15%
Coil to 1000 ft	10% to 66.75

Twin-Conductor

	No. 14 Solid
Less than coil	List to $120.00
Coil to 1000 ft	$97.75 to $100.00
	No. 12 Solid
Less than coil	List to + 15%
Coil to 1000 ft	10% to 126.80

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	15%
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	15%

Twin-Conductor

	No. 14 Solid
Less than coil	+5%
Coil to 1000 ft	5%
	No. 12 Solid
Less than coil	+5%
Coil to 1000 ft	5%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+ 10% to 12%
1/5 to std. pkg	5% to 20%
Std. pkg	23% to 44%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	12%
1/5 to std. pkg	20%
Std. pkg	44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.31	.32
Barrel lots	.28 to .2865	.29 to .2965

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.3190	.3290
Barrel lots	.2890	.2990

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
3/8	250	$5.00
1/2	250	7.50
3/4	100	10.00
1	50	13.00
1	50	21.00
1 1/4	50	26.00
1 1/2	25–50	35.00
2	25–50	45.00
2 1/2	25–50	52.00

NET PER 100 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
3/8-in. s. stp.	$75.00 to $82.50	$67.50 to 69.75
3/8-in. d. stp.	75.00 to 84.00	69.00 to 72.00
1/2-in. s. stp.	100.00 to 110.00	90.00 to 93.00
1/2-in. d. stp.	100.00 to 112.00	92.00 to 96.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
3/8-in. single strip	List	$63.75
3/8-in. double strip	78.75	71.25
1/2-in. single strip	List	85.00
1/2-in. double strip	105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
3/8	$0.05 1/2	1	$0.25
1/2	.06	1 1/4	.33
3/4	.09	1 1/2	.40
3/4	.12	1 3/4	.47
3/4	.15	2	.55
3/4	.18	2 1/4	.65

NET PER 1000 FT.—NEW YORK

	Less Than $15 List	$15 to $60 List	$60 to $150 List
3/8-in.—	$49.50–$55.00	$24.45–$41.25	$21.50–$33.00
1/2-in.—	$54.60–$60.00	$27.00–$45.00	$23.50–$36.00

NET PER 1000 FT.—CHICAGO

	Less Than $15 List	$15 to $60 List	$60 to $150 List
3/8-in.—	$60.00	$30.00	$26.50
1/2-in.—	$65.00	$32.50	$29.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 39

Size, In.	Conduit, List per Foot
1/4	$0.08 1/2
3/8	.08 1/2
1/2	.08 1/2
3/4	.11 1/2
1	.17
1 1/4	.23
1 1/2	.27 1/2
2	.37 1/2
2 1/2	.58 1/2
3	.76 1/2

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
1/4	$0.05	$0.19
3/8	.06	.19
1/2	.07	.19
3/4	.10	.25
1	.13	.37
1 1/4	.17	.45
1 1/2	.21	.50
2	.28	1.10
2 1/2	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb	+20% to 12%	+20% to 14%
2500 to 5000 lb	+20% to 15%	+20% to 17%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	1/4 to 1/2 in.	3/4 to 3 in.
Less than 2500 lb	6.8%	9.8% to 10.7%
2500–5000 lb	8.8%	11.8% to 12.7%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$5.00 to $6.00
Discount	25% to 30%

CHICAGO

List price	$5.00 to $6.00
Discount	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10% to 30%
1/5 to std. pkg	20% to 50%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30%
1/5 to std. pkg	40%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$5.00 to $7.00
1/5 to std. pkg	4.50 to 5.95

Standard packages, 500. List, each $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$7.00
1/5 to std. pkg	5.75

Standard packages, 500. List, each, $0.07

LAMPS, MAZDA

105 to 125 Volts

Regular, Clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0.30
60-watt—B	100	.35
100-watt—B	24	.70
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round Bulbs, 3½-in., Frosted:		
15-watt—G 25	50	.53
25-watt—G 25	50	.55
40-watt—G 25	50	.55
Round Bulbs, 3½-in., Frosted:		
60-watt—G 30	24	.77
Round Bulbs, 4¼-in., Frosted:		
100-watt—G 35	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg.	List
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	List
Std. pkg.	10%

LAMP CORD

Cotton Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$33.80 to $35.90
Coil to 1000 ft.	26.95 to 28.73

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$29.00
Coil to 1000 ft.	21.50

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$24.00

CHICAGO

Net per 100	$21.75

OUTLET BOXES

Nos.	List, Per 100
101—A, A1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	25% to 30%	20%
$10.00 to $50.00 list	35% to 42%	25% to 37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40%	35%
$10.00 to $50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	5%
1/5 to std. pkg.	15%
Std. pkg.	25%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$15.80 to $38.60
1/5 to std. pkg.	14.80 to 19.00

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$15.80
1/5 to std. pkg.	14.80

Standard package, 2200. List per 1000, $20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net Std. Pkg. 3500 Std. Pkg. 4000
5½ N.C.—Solid Nail-it—N.C.

Less than 1/5 std. pkg.	$11.85 to $20.00	$30.70
1/5 to std. pkg.	11.10 to 15.60	24.20

CHICAGO

Per 1000 Net. Std. Pkg. 3500 Std. Pkg. 4000
5½ N.C.—Solid Nail-it—N.C.

Less than 1/5 std. pkg.	$11.85	$20.75
1/5 to std. pkg.	11.10	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
½-in. cap key and push sockets	500	$0.33
½-in. cap keyless socket	500	.30
½-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+ 10% to 10%
1/5 to std. pkg.	5% to 8%

NET PER 100—CHICAGO

Less than 1/5 std. pkg.	10% to 29.70 to 54 cts.
1/5 std. pkg.	20% to 26.40 to 48 cts.

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100 amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+ 10% to + 5%
$10 to $25 list	List to 11%
$25 to $50 list	10% to 14%
	Low Grade
Less than $10 list	List to 5%
$10 to $25 list	10% to 16%
$15 to $50 list	15% to 24%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+ 5%
$10 to $25 list	+ 10%
$25 to $50 list	+ 14%
	Low Grade
Less than $10 list	5%
$10 to $25 list	16%
$25 to $50 list	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+ 10%
1/5 to std. pkg.	5% to 8%
Std. pkg.	23% to 25%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	28%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	40%	30%
$2.00 to $10.00 list	50%	40%
$10.00 to $50.00 list	64%	52%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2.00 list	25%	20%
$2.00 to $10.00 list	25%	20%
$10.00 to $50.00 list	25%	20%

TOASTERS, UPRIGHT

NEW YORK

List price	$5.00 to $6.00
Discount	25% to 30%

CHICAGO

List price	$6.00
Discount	25% to 30%

WIRE ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.43–$0.50
No. 18, full spools	.38– .45

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.65
No. 18, full spools	.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$15.00–$20.00	$14.00–$15.00	$11.25–$12.25
12	26.25– 27.10	20.62– 23.20	16.13– 17.05
10	36.47– 37.80	28.65– 32.40	22.40– 23.75
8	51.24– 53.35	40.26– 45.70	31.47– 33.55
6	81.06– 84.40	63.69– 72.35	50.79– 53.05

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft
14	$19.00	$14.00	$12.50
12	27.53	23.86	22.02
10	33.02	30.48	27.44
8	46.09	42.54	38.99
6	61.30	61.76	52.18

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$37.85 to $38.40
25 to 50 lb	36.40 to 37.85
50 to 100 lb	32.10 to 32.40

CHICAGO

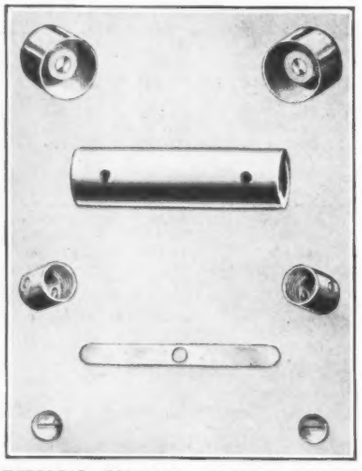
	Per 100 Lb. Net
Less than 25 lb	$37.00
25 to 50 lb	36.00
50 to 100 lb	35.00

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Improved Renewable Fuse

A renewable fuse designed to save on both first cost and maintenance outlay has recently been placed on the market by the D & W Fuse Company, Providence, R. I. The unit consists of a fiber tube having a steel sleeve held in each end by two pins. The inside of each sleeve is threaded to receive a metal plug, which is securely attached inside the brass ferrule, and the sleeve has a seat beyond the threaded portion, on which rests a slotted washer. The link is clamped between this washer and the end of the metal plug, both of which are held in position by the threaded sleeve. This insures permanent electrical contact between the link and the terminal structure, and eliminates any trouble associated with some designs of fuse in which the pressure necessary to maintain the link contact is transmitted through a part of the fiber tube, with resulting difficulties from shrinkage, expansion or warping of the fiber. In the D & W renewable fuse the threaded metal plugs which screw into the sleeves are long enough in proportion to their diameter to be readily started into the receiving thread, which avoids the difficulty of cross-threading, often encountered where thin metal disks threaded on the edge are employed. The steel parts of this fuse are oxidized to prevent "freezing" from molten or vaporized link metal, and consequent sticking after blowing on heavy overload. No tools are required

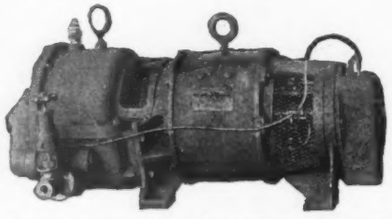


ELECTRICAL CONTACT ASSURED BETWEEN LINK AND TERMINAL STRUCTURE

in replacing a link or removing a cap. Re-fusing is effected merely by removing the caps, inserting a new link through the washers, bending one end of the link and replacing the caps. In marketing, one case is furnished for each size of the various ranges, separately supplying the different ratings of renewable fuse links. This insures a very large saving in fuse investment, both for the consumer and jobber, as it eliminates the need of carrying a complete stock of finished fuses of each rating. These fuses are at present being made in 30-amp. and 60-amp. units for 250-600-volt service.

Small Turbo-Generator Set Directly Connected

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is manufacturing a small turbo-generator set that is adaptable to surface mining, floodlighting, places where night work is essential, for electromagnet work on steam cranes, etc. The



GENERATOR SHAFT EXTENDED IS ONLY REVOLVING UNIT

unit is made for 10-kw. output, although a temporary load of approximately 12½ kw. may be obtained.

The machine is fitted with a hand and automatic throttle valve and an emergency overspeed governor. The latter feature is placed on the generator end of the unit and automatically closes the throttle valve of the turbine if the unit overspeeds. It consists of a small weight placed on the shaft of the unit which at a predetermined speed engages a trip lever connected in such a way to the throttle valve that it is automatically closed, thus stopping the turbine.

Fixture with Switch Mounted in Chain

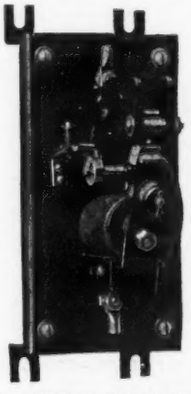
A semi-indirect lighting fixture of the chain suspension type controlled by a pull-chain switch mounted in the suspension chain is being marketed by the Peerless Light Company, 147 West Randolph Street, Chicago. The fixture is made in four general styles, the two suspension-chain styles having 13-in. and 17-in. (33-cm. and 43-cm.) chains respectively and the two ceiling styles also having 13-in. and 17-in. chains. "Peerlite" glass is used in all of the fixtures and is said to produce a daylight effect in an economical fashion. The manufacturer especially recom-

FIXTURES SHIPPED ALREADY WIRED IF DESIRED

mends these units for commercial and residential lighting. The fixtures can be sold, if the purchaser desires, already wired, and packed in individual cardboard shipping cases.

Direct-Current Magnetic Switches

The Allen-Bradley Company, 495 Clinton Street, Milwaukee, Wis., is now making direct-current magnetic switches to be installed in connection with special motor or electric-control applications. They are used to switch the current



MAGNETIC SWITCH WITH ARC CHUTE UP AND MOVABLE MEMBERS DOWN

from a remote point by means of a pilot circuit carrying a comparatively small amount of energy.

The contacts of these switches are of the copper-to-copper rolling type with liberal pressure exerted by rugged simple helical springs. The coils are large

enough to operate the switch under all reasonable voltage fluctuation without the necessity of introducing protective resistances. The magnetic frame parts are made of sheet or cast steel, thus securing maximum strength and magnetic properties with the least weight, which makes the switch of unusually quick action. The coil frames, the shape of pole pieces and the air gaps are so proportioned that if sufficient current is applied to the coil terminals to start the switch, it will close and seal.

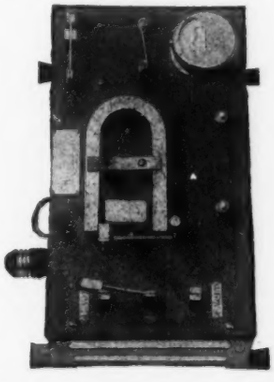
The arc chutes of the magnetic blowout are made with sufficient clearance on each side of the contacts to prevent the arc from burning through the insulation, and they are of open construction so that the air currents set up can assist the magnetic action in breaking the arc. This chute also acts as the stop for the switch in the open position, and when it is pushed up the movable member of the switch will drop down into a position suitable for cleaning and inspection. This also makes the switch inoperative, rendering it impossible to use it unless the arc chute is in place.

Erasing Outfit for Use in Drafting Room

For facilitating the work of draftsmen, the Coates Manufacturing Company, Worcester, Mass., has developed and is marketing an electrical erasing outfit. This consists of a 1/15-hp. electric motor mounted on a stand with a flexible shaft 3 ft. (0.9 m.) in length. The motor is also equipped with a stationary disk for roughing and truing the rubber eraser.

Vibrating Rectifier for Automobile Batteries

For starting all kinds of lighting and storage batteries for automobiles the Fore Manufacturing Company, Inc., 5643 Easton Avenue, St. Louis, is marketing the rectifier (type 2-B)



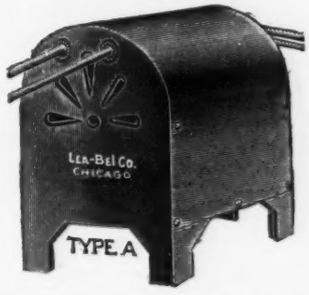
VIBRATING RECTIFIER OPERATED FROM 110 VOLTS ALTERNATING CURRENT

shown above. It is simple and practically automatic, operating from 110 volts alternating current. It will charge an automobile battery without removing it from the car. It will also charge two 6-volt, 80-, 100- or 120-amp. batteries at 6-amp. charging rate at one time. The device weighs only 27 lb. (7.7 kg.). It is operated from a 110-volt lamp socket by attaching a plug.

Transformer for Tungsten-Lamp Projection

A transformer that will control the currents applied to incandescent lamps for motion-picture projection accurately at the value specified has been placed upon the market by the Lea-Bel Company, 610 Schiller Building, Chicago. This transformer consists essentially of two—or three—separate parts—the transformer proper and the control panel for each machine. The transformer is so designed that it will supply the energy for the lamps of one machine continuously or of two machines alternately. Both machines may be operated together for some time without causing the transformer to overheat. The panelboard is arranged to be mounted on the wall of the booth convenient to the machine to be operated. A separate panel containing the ammeter and an adjustable rheostat is provided for each machine.

As it is usually desirable to start the second machine before the film of the



TRANSFORMER ACCURATELY CONTROLS CURRENT AND VOLTAGE

first one has been quite run off, the lamp can be brought up to full candlepower gradually so that the changeover can be made readily. A low-voltage connection is provided for heating the lamp. This connection also aids focusing the new lamp which is being installed. The current may be varied in steps of 0.2 amp., and the transformer will take care of the ordinary variations in line voltage. Satisfactory adjustment of the lamp may be attaincd even though the line voltage may vary from 100 volts to 125 volts. The transformer can be supplied for either 600-watt or 750-watt Mazda C. lamps for motion-picture projection.

Portable Motor-Driven Compressor for Mines

For use as an auxiliary to the main compressed-air system or for development work in coal mines without compressed-air service, the Ingersoll Rand Company, 11 Broadway, New York, has developed a small portable motor-driven air compressor. This machine can be used for operating drills, coal cutters and air lifts and for various other purposes. The complete outfit, as shown in the accompanying illustration, is mounted on a truck with flanged wheels of a gage to suit the mine track so that it can be hauled wherever it is needed. This type of compressor is made in ratings up to 415 cu. ft. (35.2 cu. m.) of air per minute and for pressures up to 100 lb. (7 hp. per sq. cm.). The motor,

COMPLETE OUTFIT MOUNTED ON A TRUCK

which is built by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is designed to operate on the available energy supply and is furnished in sizes ranging from 12 hp. to 56 hp., depending on the rating of the compressor. A large air receiver forms a part of this outfit. The air can be pumped into this receiver, and the pressure is automatically maintained.

Industrial Truck with Four-Wheel Drive

The Lakewood Engineering Company, Cleveland, Ohio, is now manufacturing a storage-battery-driven industrial truck known as model "BC." The frame dimensions are made as small as possible and take care of two compartments, one over each axle, for twenty-four cells of heavy-duty lead battery or twenty-two cells of Edison battery. These compartments form seats for the operator.

The wheels are steered through a worm and sector arrangement connecting all four wheels. An angle of 6 deg. is obtained by this method of steering, both the inside and outside wheels turning on a radius drawn to a common center. The steering column is placed in the center of the tractor, and at each side of the column is placed a steering wheel connected with the worm by chains.

The controller is placed at the top of the steering column between the steering wheels. A safety contact switch is placed at the bottom of the steering column and operates in conjunction with the controller and brake pedal, making it impossible to operate the tractor unless the controller handle is always brought to the neutral point. When the foot brake is released brakes are applied and current is cut off automatically.

The motor is set midway between axles and drives both fore and aft through worm gear on both axles. Power is transmitted from the cross shaft in the axles by a pair of bevel gears to a vertical shaft carried by the swivel hub.

Trade Notes

Changes in the Western Electric Company's Organization

A. W. BATES has taken the management of the office in New Haven, Conn. He started in at Hawthorne, Ill., in 1909, and for several years was in the A & B service department in New York City.

A. B. VANDERCOOK, who for the last six months has been a company specialist at Los Angeles, Cal., has been made sales manager of the district branch there. His connection with the Western Electric organization dates from 1916.

L. R. BROWNE has been transferred to the International Western Electric Company as credit manager. He entered the service of the company in 1916, beginning as a claim clerk in Chicago. He went to Omaha, Neb., the following year and then to Philadelphia, where he was the credit chief and cashier. Albert E. Case, formerly credit man in Boston, Mass., takes Mr. Browne's place in Philadelphia, with H. P. Litchefield, from New York, succeeding Mr. Case.

M. A. CURRAN, formerly general credit manager of the company in New York City, has taken over the management of the line material department in the general sales organization. E. W. Shepard, in charge of the credit department of the company's Cleveland branch house, succeeds Mr. Curran at headquarters in New York City. F. J. Kelly, connected with the credit end in the Chicago house, succeeds Mr. Shepard in Cleveland. These changes became effective July 8.

TYLER HOLMES, who became connected with the company in 1900, going to the various branches in the East and West and at one time manager at New Haven, Conn., goes to Denver, Col., to assume the management of that house. He succeeds Alexander Brown, whose sudden death from heart disease, while at the wheel of his automobile, occurred June 1. Mr. Brown's death deprived the company of an executive of energy, unusual business attributes and engaging personal qualities. He was the Denver manager for twelve years.

FRANK B. RAE, electrical and mechanical engineer, announces the removal of his office to 219-226 Avenue Building, Cleveland, Ohio.

THE AMERICAN ELECTRICAL WORKS of Phillipsdale, R. I., have given life insurance to all the employees of its plant of more than three months' standing.

THE WAR TRADE BOARD of Washington, D. C., in supplement No. 5, furnishes a cumulative supplement to the enemy trading list, revised, containing additions, removals and connections from March 15 to June 14, 1918.

THE DOLPH MANUFACTURING CORPORATION of Newark, N. J., manufacturer of insulating varnishes and compounds, tape tubing, etc., has placed its selling agency in New York City with John H. Barker, 95 Liberty Street.

H. G. WEDLER, for six years sales representative of the Emil Grossman Manufacturing Corporation of Brooklyn, N. Y., entered the United States military service on June 17. He is now in the mechanical repair shops, Unit 305, Camp Jesup, Atlanta, Ga.

THE JEWELL ELECTRIC INSTRUMENT COMPANY of Chicago announces that the following representatives have been added to the organization: George E. Linton, 10 High Street, Boston; Benjamin B. Baseler, Philadelphia, and the Moore Electric Company, Denver.

THE FAFNIR BEARING COMPANY of New Britain, Conn., manufacturer of ball bearings, in a war saving stamp selling campaign stands second in a long list of other local factories engaged in the same patriotic and laudable work. The per capita sales of the Fafnir company are 18.30, with total sales up to June 8 of 8419.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY is adding two extra stories to its service station at Tenth Avenue and Thirty-sixth street, New York City. This will furnish 15,000 additional square feet to the floor space to accommodate the company's increasing business at the plant. Superintendent Richards entertains hopes that the work will be completed and available by Sept. 1, as provided in the contract.

THE WESTINGHOUSE LAMP COMPANY of New York City has moved its advertising department back from 21 Park Row to the executive office at 165 Broadway.

THE PREMIER RUBBER & INSULATION COMPANY of Dayton, Ohio, is a new concern which has built a complete plant for the manufacture of molded insulation products from bakelite, condensite, etc. K. F. Englerth, the president, is the chief production engineer of the Dayton Engineering Laboratories Company, and A. Huetter, the general manager, was formerly in charge of the Delco molded products departments of the same company.

THE NEW DEPARTURE MANUFACTURING COMPANY of Bristol, Conn., on July 13 will distribute $50,000 in bonuses to its employees, accrued at the close of its business year on June 30. Those who have been in the company's employ from three to six months will be paid an extra half week's wages; six months or more, a full week. In addition the company cordially expresses its appreciation of the loyal co-operation of its employees in every department.

THE WESTERN ELECTRIC COMPANY has created a new addition to its wide activities by forming what is to be known as the government department in New York City. This has been done in order that the resources of the company may be placed at the disposal of the federal authorities to a greater extent than was possible in the past. Harry L. Grant, for many years sales manager of the Chicago house, is the manager, J. C. Enders sales manager, G. A. Sherman assistant manager, and A. L. Perry credit chief. The headquarters of the department are in the company's building at 463 West Street. The company now has dealings with forty and fifty government bureaus, and the new arrangement provides a clearing house for its multifarious transactions.

THE DOEHLER DIE-CASTING COMPANY of Brooklyn, N. Y., has just broken ground for the new addition to its factory on Court and Huntington Streets. This addition will cover 150 ft. on Court Street and 200 ft. on Huntington Street and will be ten stories high, actually doubling the present capacity of the plant. The construction will be of steel and concrete throughout, to confirm to the general character of their present structures, the last addition to which has only been occupied since Sept. 1 last. Newly perfected types of automatic die-casting machinery are now in process of construction, ready to be installed in the new building, which is to be ready for occupancy before the summer is over. While the greater portion of the company's activities are devoted to government and war work, the requirements of the regular trade, which in the main is now also for government consumption, are receiving the usual attention.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY of East Pittsburgh, Pa., at the eighth annual convention of the Tri-State Water and Light Association of the Carolinas and Georgia, held at Atlanta, Ga., was represented by Thomas Fuller. At the session held June 14 Mr. Fuller read a paper, entitled "The Electrical Industry in War Times," which attracted marked attention and was subsequently discussed with interest by the delegates. Among other pertinent things he said: "Our steam-turbine production in normal times averages 500,000 hp. per annum. Our business now to our regular customers totals more than 1,000,000 hp. In addition to this business, we are supplying 2,500,000 hp. for government vessels. Three hundred and fifty-eight vessels now under construction will be equipped with these turbines for main propulsion. In a few months we shall deliver to the government plant at Muscle Shoals a 70,000-kw. turbine, the largest generating unit in the world."

THE KILBOURNE & CLARK MANUFACTURING COMPANY of Seattle, Wash., has recently leased to the Skinner & Eddy Corporation its building and site on West Connecticut Street and has purchased a three-and-a-half acre tract at the northwest corner of Whatcom Avenue and Spokane Street, on which will be erected what will, it is said, be one of the largest wireless manufacturing plants in the world. Plans for the proposed new plant provide for four large buildings, each to be one story, with glass sides and sawtooth roofs. A machine shop, 300 ft. long and 100 ft. wide, and a two-story concrete office building will be part of the new construction. A large concrete testing laboratory will also be built, and all floors in the buildings will be of concrete. Improved methods will be employed in construction, and provide that all materials move one way until they emerge from the testing laboratory in the form of the finished product. The Shipbuilding Corporation's lease provides that the Kilbourne & Clark Company's property shall be vacated by Oct. 1. Plans for the new wireless plant are rapidly taking form. It is announced that the plant, when completed, will cost about $250,000. In the year ended June 30, the Kilbourne & Clark Company manufactured the wireless sets for more than 400 ocean-going ships, including naval and cargo vessels for the government.

Trade Publications

CONDUIT SEAL.—Barnes & Irving, Inc., Syracuse, N. Y., is distributing a circular describing the Misener safety conduit seal.

WIRES.—Advances in price and list prices of bare and tinned copper wire, magnet wire, cotton, silk and enamel have been issued by the Rome Wire Company, Rome, N. Y.

INSULATING TAPE.—The Good Manufacturing Company, 106 North Wells Street, Chicago, has issued a post-card folder showing samples of uncoated tape and of varnished cambric.

ROTARY HACK SAW. — Barnes & Irving, Inc., Syracuse, N. Y., is distributing a circular describing the Misener expanding rotary hack saw for cutting circular holes in metal, wood, slate, marble, etc.

ELECTRIC FANS.—Combination desk and wall type direct-current and alternating-current fans are illustrated and described in a circular that is being distributed by Bodine Electric Company, Chicago. Data and list prices of these fans are given.

BATTERY - CHARGING DEVICES. — Bulletin 318, issued by the Automatic Electrical Devices Company, 12 Opera Place, Cincinnati, Ohio, gives descriptions of charging panels for storage battery stations and also shows the electric "chargometer" for installation on trucks or storage-battery cars.

ELECTRICAL INSTRUMENTS. — The Jewell Electrical Instrument Company, 810 West Lake Street, Chicago, has issued an illustrated catalog showing its line of electrical measuring instruments. Among the instruments included in this bulleting are the laboratory standard portable, general utility portable, inspector's portable, duplex portable, stardard round pattern and automobile meters. The functions of the engineering and repair departments of this company are outlined and the construction features and moving elements of the instruments are described. Price lists are given for all meters except alternating-current instruments lower than 50 volts.

STARTING SWITCH FOR MOTORS.—The Cutler-Hammer Manufacturing Company of Milwaukee, Wis., has issued a pamphlet which shows four typical installations of the C-H 9116 starting switch for squirrel-cage motors. An interior view shows the construction and arrangement of the starting and running contacts, fuses, etc. The manner by which the motor is connected to the line ahead of the fuses and then automatically engages the fuses without opening circuit to the motor in the transition is clearly shown. Attention is called to the fact that the sizes made up to 3 hp., 110 volts, and up to 5 hp., 220 440 and 550 volts, give this alternating-current inclosed starter a wide field of application because of the extensive use of squirrel-cage motors of the ratings specified.

ILLUMINATION.—"The Lighting of Offices and Drafting Rooms" is the title of bulletin No. 35, now being distributed by the engineering department of the National Lamp Works of the General Electric Company. In this bulletin some of the data have been adapted from electrical and technical papers by Ward Harrison, illuminating engineer of the National Lamp Works. The subject of office lighting is discussed under five principal subdivisions—quantity of light, quality, utilization, location and number of lighting units, and illuminating calculations. Illustrations show the effect of different types of lighting units in offices and drafting rooms, and curves are given showing the number of rows of units needed for different lengths or widths of offices or drafting rooms. This chart is designed to simplify the location of lighting units in offices.

New Incorporations

THE FAWN TOWNSHIP LIGHT & POWER COMPANY of New Park, Pa., has been incorporated with a capital stock of $20,000 by H. M. Johnson and others.

THE DUAL WELDING APPARATUS COMPANY of Elizabeth, N. J., has been chartered with a capital stock of $50,000 by M. Lucas, Frederick De Meese and Robert Zuber of Elizabeth. The company proposes to manufacture welding equipment.

THE FEDERAL ELECTRIC & MANUFACTURING COMPANY of McKee's Rocks, Pa., has been incorporated by Miles Bryant and associates. The company is capitalized at $50,000 and proposes to manufacture electrical goods.

THE AHLGREN LIGHT & STORAGE BATTERY COMPANY of Terre Haute, Ind., has been chartered with a capital stock of $25,000 to manufacture batteries and lighting systems. The incorporators are William T. Kincaid, Reilly C. Adams and H. C. Austill.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

New England States

BIDDEFORD, ME.—Arrangements are being made by the Peperell Manufacturing Company to secure energy from the Clark Power Company at Union Falls. The cost of developing the plant at Union Falls and erecting of a 11,000-volt transmission line to Biddeford is estimated at $50,000. There is already a waterwheel at the Union Falls Plant, and three others will be installed this summer, for which orders have been placed. It is planned to develop about 700 hp. The Peperell company, it is stated, proposes to equip its entire plant for electrical operation after the war. The York County Power Company is unable to furnish service to the Peperell company at the present time. It is expected to have the plant completed by November so as to provide for the coal shortage this winter.

MONTAGUE, MASS.—The Turners Falls (Mass.) Power & Electric Light Company has purchased a site on Whitney Avenue, which will be used in connection with future developments of its plants.

ORANGE MASS.—Plans are being considered by the New Home Sewing Machine Company, 45 East Seventeenth Street, New York, N. Y., for additions to its plant in Orange, to cost more than $150,000. Work has been started on an addition, to cost about $75,000. Francisco & Jacobus, 511 Fifth Avenue, New York City, are engineers.

WHITMAN, MASS.—The Selectmen have signed the new electric light contract with the Edison Electric Illuminating Company of Brockton under which the company will furnish 36 additional lamps of 60 cp. The contract is for a period of five years. Work will begin at once on the erection of the new lamps.

NORWICH, CONN.—The Shore Line Electric Railway Company, is planning to erect a new high-tension transmission line from Norwich through the Quinebaug Valley to the Massachusetts line in the town of Thompson.

Middle Atlantic States

AKRON, N. Y.—Plans are being prepared by Reidpath & Son, Builders' Exchange, Buffalo, architects and engineers, for the erection of a power house in Akron for the Wheat's Ice Cream Company, 236 Elm Street, Buffalo, N. Y.

ALBANY, N. Y.—The Board of Contract and Supply has awarded contract for the new lighting fixtures for the remodeled city hall to Edward F. Caldwell & Company of New York, at $15,000.

BROOKLYN, N. Y.—The Kenyon Company, 754 Pacific Street, has awarded contract to Charles E. Knox, 10 Park Avenue, New York City, for electrical work in connection with the construction of its new plant. The cost of the entire plant is estimated at about $375,000.

BUFFALO, N. Y.—The engine plant and a number of other buildings at the Erie County Home and Hospital were recently destroyed by fire, causing a loss of more than $150,000.

BUFFALO, N. Y.—Plans are being prepared for the erection of a new plant, 195 ft. by 415 ft., for the General Electric Company, to be situated at East Ferry Street and Fillmore Avenue. The plant will cost about $250,000 and will be used for the manufacture of incandescent lamps.

EAST ROCHESTER, N. Y.—Bids, it is reported, will soon be asked by the Merchants' Dispatch Transportation Company for the construction of a new plant, 150 ft. by 1000 ft., one story, to cost about $500,000. R. Yates is engineer.

ITHACA, N. Y.—Notice has been filed with the Public Service Commission by the Ithaca Gas & Electric Company of a change in its name to the New York State Gas & Electric Corporation.

NEW YORK, N. Y.—A general machine and repair shop, 110 ft. by 200 ft., will be erected in connection with the proposed automobile garage to be established on Second Avenue between Forty-seventh and Forty-eighth Streets, by the Interstate Garages, Inc., of New York.

NEW YORK, N. Y.—The proposed extensions and improvements to be made by the Interborough Rapid Transit Company, for which a bond issue for $37,700,000 is being arranged with the War Finance Corporation, include extensions in power plants, electric substations and transmission lines of the company, also improvements in existing electrical apparatus, to cost about $2,391,000; improvements in electric interlocking and other signal apparatus, $3,371,000; electrical machinery and equipment for substations, equipment for electric transmission and distribution systems, $7,886,000.

NIAGARA FALLS, N. Y.—The United States Light & Heat Company, 3215 Highland Avenue, Niagara Falls, is contemplating building a new factory building, 150 ft. by 300 ft., one story, to cost about $75,000. The company manufactures heating specialities. Mill, Rhines, Bellman & Nordoff, Ohio Building, Toledo, Ohio, are architects.

POTSDAM, N. Y.—Bids will be received by Dr. Thomas E. Finnegan, Deputy Commissioner of Education, Education Building Albany, until July 24 for interior telephones, clocks, program bells and fire-alarm system for the State Normal and Training School at Potsdam. Drawings and specifications may be consulted at the above school, Potsdam, at the New York office of the Department of Architecture, Room 1224, Woolworth Building, and at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is state architect.

WATERTOWN, N. Y.—Plans are being prepared by T. L. Tomlines, City Bank Building, Syracuse, for a building, 90 ft. by 120 ft., one story, for an electric plant. The cost is estimated at about $75,000.

BAYONNE, N. J.—Contract has been awarded by the Board of Education to the Dugan-Foerst Engineering Company, 499 Broadway, for electrical work in Public School Building No. 3, at $3,970.

BOONTON, N. J.—Plans are under consideration by the Board of Aldermen for the installation of a new electrical operated pumping unit at the municipal water-works system.

CAMDEN, N. J.—Plans are under consideration by the City Council for extension to the street-lighting system on Mount Ephraim Avenue, beginning at Ferry Avenue.

CAMDEN, N. J.—Plans are being prepared for extensions to the power plant of the New York Shipbuilding Company. Considerable new equipment, including a generating set, condenser, etc., will be installed. Marvin A. Neeland is president.

GLOUCESTER, N. J.—Plans are being considered by the Public Service Railway Company for the construction of a branch traction system to the proposed new town site to be developed by the New York Shipbuilding Corporation.

KEARNEY, N. J.—Preparations are being made by Henry Ford for the erection of a plant in Kearney for the production of patrol boats and submarine chasers, to cost about $2,000,000, for which plans have been approved in Washington. A concrete building, 960 ft. by 200 ft., is already under way. Another building, 1400 ft. by 400 ft., will be erected.

TRENTON, N. J.—An ordinance has been passed by the Board of Aldermen authorizing the Public Service Railway Company to erect new poles and equipment for its traction line in Adeline Street, extending from Liberty to Cass Street.

ALTOONA, PA.—Work has been begun by the Pennsylvania Railroad Company on the installation of a new telephone and telegraph system between Altoona and Marysville on its middle division.

BRAEBURN, PA.—The Marlin-Rockwell Corporation of New York has purchased the property of the Braeburn Steel Company at Braeburn for $1,000,000. It is understood that another plant, equipped with a 6-ton electric furnace, will be erected within 18 months.

FARRELL, PA.—Contracts have been awarded by the County Commissioners for the construction of a new power plant. The new building will cost about $10,000 and the new equipment, including boilers, conduit work, wiring, etc., will cost about $15,000. E. S. Clepper of Sharon is architect.

HARRISBURG, PA.—Work has been begun on the installation of new equipment in the plant of the Harrisburg Light & Power Company, including two double fans, two 150-hp. turbines and auxiliary apparatus. It is also planned to install a new 510-hp. boiler in the near future.

MIDDLETOWN, PA.—A large electric substation will be erected by the United States government at the new local supply station now being erected here.

NORTH BESSEMER, PA.—Contract has been awarded by the Newfields By-Product Coal Company for the construction of a new power plant, 40 ft. by 125 ft., at its works to the Nicola Building Company, Dennison and Penn Avenues, Pittsburgh.

PHILADELPHIA, PA.—A metal-working shop and other mechanical departments will be erected in connection with the proposed occupational school to be established by the School of Occupational Therapy, Philadelphia. Major Tait McKennie and Dean Graves of Philadelphia are interested in the school. Mrs. H. Gordon McCouch is chairman of the committee.

PHILADELPHIA, PA.—Plans are being prepared by the Pennsylvania Railroad Company for extensions and improvements at its various shops, including the construction of new engine plants at South Amboy and at Kearny, N. J., and also extensions to the engine plant at Phillipsburg, N. J., and various other locations. The company will also build new engine plants at its Blairville and York shops.

PITTSBURGH, PA.—Extensive improvements are contemplated by the Duquesne Light Company, involving an expenditure of about $2,000,000, of which contracts for $1,200,000 have already been placed. This does not include the proposal of the United States government to have the company build a new plant to be operated under federal supervision.

SCRANTON, PA.—Notice has been filed with the Public Service Commission by the Barren Light & Power Company of an issue of $50,000 in bonds, the proceeds to be used for extensions and improvements to its system.

SHARON, PA.—Contracts have been awarded by the County Commissioners for the construction of the new power plant at the county farm. The new building will cost about $10,000, and the equipment, including boilers, conduit work, wiring, etc., will cost about $15,000. The general contract was awarded to H. W. Bell of Greenville, and that for boilers to the Union Iron Works of Erie.

WILLIAMSPORT, PA.—Contract has been awarded by the Lycoming Rubber Company for the construction of a new boiler plant, to cost about $50,000, to the McNally Building Company, Framingham, Mass.

CUMBERLAND, MD.—Contract has been awarded by the Baltimore & Ohio Railroad Company to Westinghouse, Church, Kerr & Company, 37 Wall Street, New York, N. Y., for the construction of building, 200 ft. by 800 ft., for rebuilding locomotives, to cost about $1,500,000.

MAGNOLIA, MD.—Plans are being prepared for the erection of ten new buildings, each about 100 ft. by 200 ft., for manufacturing munitions at the Edgewood Arsenal, to cost about $200,000. Captain Hall is in charge.

MERCERS, W. VA.—Contract has been awarded by the Mercers Mining Company to the Charleston Concrete Construction Company, Union Trust Building, Charleston, for building power house and cottages.

MOUNDSVILLE, W. VA.—The United States Smelting Corporation, Frisco Building, Joplin, Mo., is planning to erect a plant for smelting ore in Moundsville, at a cost of about $1,000,000. C. E. Marshall, of Joplin, Mo., is manager.

NEWPORT NEWS, VA.—The Newcomb Life Boat Company is contemplating the installation of additional equipment, involving an expenditure of about $50,000, exclusive of derrick crane and plain crane, to cost $30,000 and $25,000 respectively.

NORFOLK, VA.—Plans are being prepared by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of power house, installation of generating equipment, piping and laundry machinery for hospital reservation at Norfolk.

PETERSBURG, VA. — The American Electric Tool Company, which manufactures electric calking tools, etc., is contemplating an addition to its plant.

ROANOKE, VA.—The Virginia Railway & Power Company has been granted a franchise by the City Council to construct a line on York Street between Boush and Granby Streets.

SHENANDOAH, VA.—Contract has been awarded by the town of Shenandoah for the construction of a hydroelectric power plant, to cost about $55,000. The town now operates a steam plant.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Various, Schedule 1866—70,000 sq. ft. high-pressure insulating blocks, miscellaneous magnesia blocks, 175,000 lb. magnesia plastic cement, miscellaneous magnesia pipe covering, fiber asbestos felting, asbestos millboard, 38,725 lb. wick or rope asbestos packing, 47,750 lb. asbestos paper and 271,000 lb. asbestos plaster. Applications for proposal blanks should designate the schedule desired by number.

North Central States

DETROIT, MICH.—Plans are being prepared by A. Kahn, 58 Lafayette Building, architect, for construction of a garage and storage building for the Detroit Evening News Association to cost about $150,000.

AKRON, OHIO.—Failing to reach an agreement with the Northern Ohio Traction & Light Company, the County Commissioners have announced that they will advertise for bids for the erection of an electric transmission line to connect the wires of the company at Tallmadge with the new County Infirmary.

CLEVELAND, OHIO.—Plans are being prepared by the New York Central Railroad Company, St. Clair Avenue and West Third Street, for the construction of a new locomotive repair shop, 97 ft. by 263 ft., one-story, at 564 East 152d Street, to cost about $150,000.

DENNISON, OHIO.—Extensions and additions to its shops and yards at Dennison are under consideration by the Pennsylvania Lines West. The proposed work will cost from $2,000,000 to 3,000,000, and will include the installation of new equipment at the shops, a new freight yard and enlargement of roundhouse and shops, etc.

GERMANTOWN, OHIO.—At an election held recently the proposal to sell the municipal electric light plant was carried. The Dayton Light & Power Company has submitted a proposal to the Council to furnish electricity for lighting the streets and for domestic purposes in Germantown.

HOLGATE, OHIO.—The local municipal electric light plant has been purchased by W. P. Wallace. Contract has been awarded by the new owner to D. B. Douty of Defiance for the erection of a three-phase transmission line from Definance to Holgate. Electricity will be secured from the plant of the Defiance Gas & Electric Company. Mr. Wallace has been granted a twenty-five-year franchise and a ten-year contract. Later the line may be extended to Hamler to furnish electric service there.

MINGO JUNCTION, OHIO.—The Cleveland & Pittsburgh Railroad, division of the Pennsylvania Railroad Company, it is reported, is contemplating an expenditure of about $6,000,000 for yard and shops at Mingo Junction. T. Rodd of Pittsburgh, Pa., is chief engineer.

STRUTHERS, OHIO.—Extensive improvements are contemplated by the Struthers Furnace Company involving an expenditure of about $500,000. The proposed work will include the installation of a complete slag-crushing plant, new engines and new generators. A. B. Stough of Struthers is engineer.

LOUISVILLE, KY.—The installation of a power plant is reported to be under consideration by the Inman Veneer & Panel Company.

LOUISVILLE, KY.—The construction of a powder manufacturing plant is under consideration by the War Department, Washington, D. C., and a site has been purchased. The plans provide for an expenditure of between $10,000,000 and $20,000,000, including land, buildings, machinery, public utilities, etc. The plant will be built by the Du Pont Engineering Company of the E. I. du Pont de Nemours Company, Wilmington, Del.

WEST POINT, KY.—The installation of an electric light plant to supply electricity for both commercial and municipal lighting is under consideration. Crutcher & Starks are reported interested in the project.

INDIANAPOLIS, IND.—Extensive improvements and additions are contemplated to the works of the Mid-West Engine Company, involving an expenditure of more than $1,000,000. The company is a consolidation of the Lyons-Atlas Engine Company of Indianapolis and the Hill Pump Company of Anderson, and will manufacture a large number of turbines for the United States Fleet Corporation.

KOKOMO, IND.—Arrangements, it is said, have been completed for the construction of a large shell plant in Kokomo by the United States government, to cost about $2,700,000. The proposed plant is to be built and operated by the Kokomo Steel & Wire Company, the money being provided by the government. Another open-hearth furnace, in addition to the three already operated by the company, will be installed.

PERU, IND.—Surveys have been completed of the Wabash, Mississinewa and Eel Rivers by W. H. Bassett, hydraulic engineer, Springfield, Ohio, for water-power development for the city of Peru. The City Council is considering the erection of a large power plant on one of the streams. It is estimated that 250 hp. can be developed on the Mississinewa River, 4 miles east of Peru, from water impounded by a 25-ft. dam.

SEYMOUR, IND.—Improvements are being made to the local plant of the Interstate Public Service Company.

CARBONDALE, ILL.—The Illinois Central Railway Company has awarded the general contract for the erection of several buildings in Carbondale, including power house, machine shop, and roundhouse, to cost about $150,000.

MATTOON, ILL.—Application has been filed by the Central Illinois Public Service Company with the Public Utilities Commission for a certificate of convenience and necessity to erect and operate a 16,000-volt transmission line from Milford, Iroquois County, through Iroquois, Kankakee and Vermilion Counties to Hoopeston.

MILWAUKEE, WIS. — The National Brake & Electric Company, Belleview and Cambridge Streets, is planning to erect a new foundry, 40 ft. by 130 ft., to cost about $22,000.

MILWAUKEE, WIS. — The Hercules Steel Casting Company, Free Press Building, has awarded the general contract for the construction of its new electric foundry plant on Robinson Avenue, near Becher Street, in Bay View. The building will be 90 ft. by 300 ft., equipped with a 5-ton electric furnace. The cost of the plant is estimated at about $100,000.

SHEBOYGAN, WIS.—The Eastern Wisconsin Electric Company, it is reported, will build an extension from Black Creek to Appleton this summer.

WEST ALLIS, WIS.—Contract has been awarded by the Gerlinger Steel Casting Company of Milwaukee, which operates an electric steel casting plant, for the erection of a building, 80 ft. by 171 ft. by 200 ft., at its plant, to be equipped with a 3-ton Moore electric furnace and a 5-ton electrically-operated crane. Contracts for most of the equipment have already been placed. Robert L. Reisinger, First National Bank Building, is general contractor.

ST. PAUL, MINN.—The construction of a six-story industry incubator, 125 ft. by 400 ft., and a cold-storage plant, 200 ft. by 200 ft., six stories high, is under consideration by the Central Warehouse Company, Pillsbury and Territorial Road. The cost is estimated at about $750,000. C. P. Bratnobe is president.

ELKHART, IOWA.—The Board of Railroad Commissioners of Iowa has granted the town of Elkhardt a franchise to erect and operate electric transmission lines on certain roads and highways in Polk County for a period of 25 years. Electricity for operating the system will be secured from the transmission line of the Fort Dodge, Des Moines & Southern Railroad Company of Boone, Iowa.

GRINNELL, IOWA.—The Community Hospital Association has awarded general contract for the construction of main building and isolation building to C. W. Ennis, of Toledo, Iowa, at about $47,000. Separate contracts will be let for electric wiring and plumbing. The cost of the buildings is estimated at about $55,000. Proudfoot, Bird & Rawson, Hubbell Building, Des Moines, Iowa, is architect.

HUMBOLDT, IOWA.—The Board of Education has awarded general contract for the construction of a new high school building to the Madison Construction Company of Minneapolis, Minn. The cost of the building is estimated at $110,000. G. L. Lockhart, 391 Endicott Building, St. Paul, Minn., and 539 Youngerman Building, Des Moines, Iowa., is architect.

OTTUMWA JUNCTION, IOWA.—The Chicago, Milwaukee & St. Paul Railway Company is planning extensions and improvements to its terminal facilities at Ottumwa Junction, to cost about $500,000. The work will include a pumping station and filter plant of 70,000 gal. capacity, etc. C. F. Loweth, Railway Exchange Building Chicago, Ill., is chief engineer.

WEBSTER, IOWA.—The Central Illinois Railway Company is planning to build a 1-story machine shop and power house in Webster, to cost about $75,000.

BEVIER, MO.—The installation of a municipal electric generating plant is reported to be under consideration. Energy to operate the system is now purchased from the city of Macon.

JEFFERSON CITY, MO.—The Hays Wood Product Company is contemplating the construction of a power house, to cost about $20,000 to supply electricity for lighting and heating its factory.

JOPLIN, MO.—The Kirkwood Mining Company is contemplating the construction of a 150-ton concentration plant and will require sludge tables, motors and crushers. The cost is estimated at $40,000. S. A. Smith is general manager.

JOPLIN, MO.—The New Carolyn Metal Company has purchased the property of the Neosho Granby Metal Company and proposes to build a new 300-ton mill and to double the output of the present 150-ton mill. The company will purchase new equipment, including crushers, air compressors, engines and boilers, etc. The cost of the work is estimated at $100,000.

SPRINGFIELD, MO.—Arrangements are being made by the Springfield Gas & Electric Company for the erection of a new power house for the new 10,000-hp. steam turbine and other equipment for the proposed new power plant. The new turbine, it is understood, has been delivered and temporary quarters will be provided at the west shops of the Frisco railroad.

NEW ENGLAND, N. D.—The Asby Light & Power Company, it is reported, will soon ask for bids for construction of a flour mill and an electric lighting plant, to cost about $25,000.

BELVIDERE, NEB.—The contract for the installation of the electric distribution system in Belvidere has been awarded to the Mid-West Electric Company of Omaha, at $5,446. Charles F. Sturtevant is engineer.

DE SOTO, KAN.—The contract for heating, electric wiring and plumbing the rural high school building in De Soto has been awarded to the MacMahon Company, of Kansas City, Mo., at $10,448.

GARNETT, KAN.—Contracts have been awarded by the city of Garnett for improvements to the municipal electric-light plant and water-works system as follows: For construction of dam to the Chanute (Kan.) Construction Company, at $10,850; for a 200-kw. generator and engine, switchboard and boiler to the Merkle Machinery Company of Kansas City, Mo., at $16,104 and $5,275 respectively. Contracts have not yet been awarded for chimney and motor-driven pumps. Black & Veatch, Inter-State Building, Kansas City, Mo., are engineers.

MORAN, KAN.—Negotiations have been closed whereby the municipal electric light plant in Moran will supply electricity to operate the municipal lighting system in Bronson. The town of Bronson will install its own lighting system and erect a transmission line from that town to connect with the local plant.

PALCO, KAN.—In a decision handed down June 8 by the Supreme Court in the suit of J. H. Lee against the city of Palco, it was declared that Kansas towns may vote bonds for a combined light and water plant without a separate bond issue covering each class of municipal utility. Mr. Lee brought suit to prevent the city issuing bonds for a combined water and light plant on the grounds that the bond proposition was a dual matter and that the taxpayers should vote on each proposition separately.

WILLIAMSBURG, KAN.—A tentative contract has been drawn up between the city of Williamsburg and Ottawa whereby the latter will furnish electricity to operate the municipal electric lighting system in Williamsburg. The City Council is considering calling an election to submit the proposal to issue $12,500 in bonds to erect an electric transmission line to Ottawa.

Southern States

SOUTHWEST LA GRANGE, GA.—At an election to be held July 24 the proposal to issue $25,000 in bonds for the installation of an electric lighting system will be submitted to the voters. Post office address, La Grange.

SOUTH JACKSONVILLE, FLA.—The city is considering an issue of $100,000 in bonds for extensions to the electric lighting system and water works.

MOBILE, ALA.—The Navy Department, Washington, D. C., has appropriated $10,000 for ice plant and passenger elevator for the Marine Hospital in Mobile.

SARDIS, MISS.—The Panola Electric Light & Power Company, it is reported, is planning to rebuild its plant, recently destroyed by fire.

MARVEL, ARK.—The Marvel Light & Ice Company, recently incorporated, is contemplating the construction of an electric plant. The company is capitalized at $20,000. H. B. Mayo, L. S. Cook and others are interested in the company.

PARAGOULD, ARK.—The City Council is considering the installation of a municipal electric-light and power plant in Paragould.

KURTHWOOD, LA.—The Vernon Paris Lumber Company, recently incorporated with a capital stock of $500,000 by J. H. Kurth, Jr., and others, proposes to construct a sawmill with steam power plant. It also proposes to establish a town site and install public utilities. Kurthwood has not a post office.

BRISTOW, OKLA.—The Oklahoma Gas & Electric Company has been granted permission by the County Commissioners to use certain highways for the erection of electric transmission lines.

PEORIA, OKLA.—Plans have been prepared by the Nebo Lead & Zinc Company for the construction of a 150-ton concentration plant, to cost about $60,000. The equipment will include air compressors, engines, boilers, tracks, ore cars, belts, conveyors, ore crushers, etc. R. C. Croslen is superintendent.

PICHER, OKLA.—The Commonwealth Zinc & Lead Company of Miami is planning to rebuild its local mill destroyed by fire, at a cost of about $100,000. New equipment, including boilers, engines, conveyors, crushers, belts, etc., will be required. L. N. Dana of Joplin is superintendent.

AUSTIN, TEX.—The Southwestern Telephone & Telegraph Company is planning to build an exchange building at Tenth Street and Congress Avenue.

KILGORE, TEX.—The plant of the Kilgore Electric Light & Power Company was recently destroyed by fire.

Pacific and Mountain States

CLEAR LAKE, WASH.—Preparations are being made by the Clear Lake Lumber Company for the erection of a large sawmill to replace the plant recently destroyed by fire. The new mill will be operated by electricity generated at the mill. A complete power plant will be installed.

HOQUIAM, WASH.—Preparations are being made for equipping the pumping stations of the Hoquiam Water Company for electrical operation. Energy will be supplied by the Gray's Harbor Lumber Company's power plant, 5 miles distant, which will require the erection of 15 miles of copper wire.

NORTHPOINT, WASH.—The Electric Point Mining Company of Northpoint is contemplating the construction of a railway, 10 miles long, to connect its railroad at Leadpoint with the Great Northern Railroad at New Boundary. R. A. Young is manager.

OLMPIA, WASH.—The City Council has awarded the Olympia Light & Power Company a contract to furnish electricity for pumping the water supply for a period of three years.

OLYMPIA, WASH.—All bids for the construction of power house and heating plant at the State School for Girls at Grand Mound have been rejected by the Board of Control and the work will be done by day labor. The lowest bid was submitted by S. G. Morin, of Spokane, at $16,735, which was $8000 more than the appropriation.

SEATTLE, WASH.—Plans are being prepared by Daniel Huntington, city architect, for an addition of another floor to the municipal auxiliary steam-driven electric plant at Eastlake Avenue and Nelson Place. The additional space is to be used as an electrical testing laboratory.

SOUTH BEND, WASH.—The Willapa Power Company has been given permission to condemn property for its proposed large dam, which will make it possible for the company to supply the city with water.

WASHOUGAL, WASH. — The power plant of the Western Light & Power Company was recently destroyed by fire, causing a loss of about $25,000. C. W. Cottrell is president.

WATERVILLE, WASH.—The Douglas County Commissioners have granted the Chelan Falls Power Company a franchise to erect and operate electric transmission lines along certain roads in Columbia County.

EL CENTRO, CAL.—Steps have been taken by the Chamber of Commerce for improvement of the lighting, power and water service in El Centro. A committee has been appointed to make investigations and to interview the Holton Power Company and the officials of the State Railroad Commission relative to inviting competition in the valley.

EUREKA, CAL.—Negotiations are under way between the Humboldt Transit Company and the Western States Gas & Electric Company whereby the latter will furnish electricity to operate the transit system of the former.

FRENCH GULCH, CAL.—The power plant of the Hazel Creek Gold Mining Company on Crystal Creek was recently destroyed by fire, causing a loss of about $30,000. The town of French Gulch is at present without electrical service.

LOS ANGLES, CAL.—Marcus Pluth, 111 West Nineteenth Street, Los Angeles, is contemplating the construction of a hydroelectric power plant on Snow Creek, Riverside County, to supply electricity to operate a Portland cement plant to be established on the Whitewater River and for local service in Riverside County. The cost of the cement plant is estimated at about $500,000.

MARYSVILLE, CAL.—Contract has been awarded by the Marysville-Nevada Light & Power Company to Oscar Ford of Riverside for the construction of a reinforced-concrete dam across the Yuba River at Bullard's Bar, about 40 miles from Marysville.

SAN PEDRO, CAL.—The Union Oil Company is planning a large addition to its local refinery. Contract has been awarded for the erection of a power plant on a site north of the west basin to the Davidson Construction Company, to cost about $25,000.

VISALIA, CAL.—A joint application has been filed with the State Railroad Commission by the Mount Whitney Power & Electric Company, the H. G. Lacey Company and the Southern California Power Company for authority for the Mount Whitney company to purchase all the capital stock of the Lacey company, amounting to $101,999, which is now owned by the Huntington Land & Improvement Company. The Mount Whitney Company asks for authority to issue 2000 shares of its preferred stock in payment of the stock of the Lacey company. The Southern California Power Company proposes to purchase the stock of the Mount Whitney Company. The Lacey Company supplies electricity obtained from the San Joaquin Light & Power Company in Hanford, Kings County.

PORTLAND, ORE.—The Big Bend Transit Company, which proposes to contruct an electric railway from Portland down the Spokane River to its junction with the Columbia River at Miles, is planning to purchase the overflow lands on the south side of the river in connection with the construction of its proposed hydroelectric power plant.

WILSONVILLE, ORE.—The local electric light plant, owned by N. B. Young, has been sold to the Mollalla Electric Company of Canby.

MOUNT PLEASANT, UTAH. — The municipal electric plant and water-works system was damaged recently by a flood caused by a cloudburst.

PRICE, UTAH.—The City Council has entered into a contract with the Utah Power & Light Company, Salt Lake City, to purchase energy to operate the municipal electric system for a period of ten years beginning Aug. 1, 1918.

FORT GRANT, ARIZ.—The Commission of State Institutions has decided to install a central lighting and power plant at the Boys and Girls' Industrial School at Fort Grant, to cost about $12,000. The proposed plant will furnish electricity for lighting twenty-eight buildings on the campus and also power for operating the sawmill, laundry machinery and machinery for the school tailoring shop and shoe shop.

CHULA, MONT.—Arrangements are being made for the installation of an electric-lighting system in Chula. A corporation controlled by the Automatic Electric Light Company of Kansas City, Mo., has been granted a franchise to operate an electric plant here. F. I. Willmont is vice-president of the company.

PIKEVIEW, COL.—The Golden Cycle Mining Company is contemplating the construction of an electric power plant in Pikeview, to cost about $200,000.

GOLDFIELD, NEV.—The Red Hills Florence Company has taken a lease on several claims of the Florence Goldfield group and also on adjacent claims of the Goldfield Consolidated. Arrangements have been made for the erection of an electric transmission line to Gold Mountain and for the establishment of a camp.

PORTALES, N. M.—An election has been called for the City Council to vote on the proposal to issue $$$20,000 in bonds, extensions and improvements to the electric lighting, water-works and sewer systems.

Canada

VANCOUVER, B. C.—The new Point Grey substation of the British Columbia Electric Railway Company at King Edward Avenue and the Lulu Island tracks is nearing completion. The new station will be equipped with two 1000-kw. rotary converters and one 1500-kw. motor-generator; both air-blast and water-cooled transformers will be used.

HAMILTON, ONT.—The construction of a technical school in Hamilton, to cost about $130,000, is under consideration. F. R. Close is chairman of the technical committee.

SANDWICH, ONT.—The H. Walker Company of Walkerville is contemplating the construction of a dye plant in Sandwich, to cost about $1,000,000.

COBALT, ONT.—Preparations are being made for the installation of electrically driven machinery at the mining property of the Ontario Kirkland Gold Mines Company. Right-of-way is now being cleared for the erection of an electric transmission line and additional camp buildings are being erected.

LEVIS, QUE.—The Levis County Railway Company has awarded contract to M. Loneigan, 1254 St. Valier Street, Quebec, for improvements to its electric railway system, at about $125,000.

TEMISKAMING, QUE.—The Riordan Pulp & Paper Company, 355 Beaver Hall Square, Montreal, is contemplating the construction of a sulphite mill and power house in Temiskaming.

REGINA, SASK.—Plans are under consideration by the City Council for extending the municipal street railway system into the North Annex.

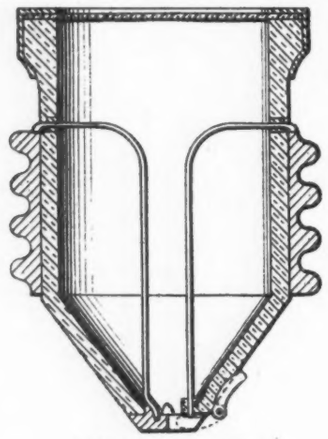
Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until July 24 for sheet copper, street lamps, fuses, batteries, outlet boxes, conduits, reflectors, sockets, switches, fans, copper wire, cable and clips, vulcanizing material, etc. Blanks and information relating to this circular (1222) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 606 Common Street, New Orleans, La., and Fort Mason, San Francisco, Cal.

1,266,736. SUPPORT FOR TELEGRAPH LINE WIRES AND THE LIKE; James Wilson, Wichita Falls, Tex. App. filed July 31, 1917. Brackets for holding telephones, telegraph and electric light wires, comprising a cross-bar having vertical and horizontal openings and clamps secured therein.

1,268,574. MOTOR CONTROLLER; Albert J. Horton, White Plains, N. Y. App. filed June 4, 1915. Relates to controllers for motor-driven printing presses.

1,268,777. TRANSMISSION MECHANISM; George M. Willis, Chicago, Ill. App. filed Feb. 7, 1914. Provides a variable-speed transmission gearing and devices electrically effecting the engagement, with necessary gears to secure any desired speed.



1,268,824—Fuse Plug

1,268,795. ALTERNATING-CURRENT RECTIFIER; Thomas J. Murphy, Rochester, N. Y. App. filed June 17, 1916. An electricity rectifier wherein current rectified will be substantially constant in potential.

1,268,812. TERMINAL; Charles W. Beck, Detroit, Mich. App. filed Jan. 4, 1915. An efficient terminal that may be quickly attached to or detached from a binding post.

1,268,824. FUSE PLUG; Joseph A. Dugan, Houston, Tex. App. filed Oct. 1, 1917. A fuse plug wherein a plurality of fusible wires are employed.

1,268,849. PROCESS FOR MAKING ALLOYS OF PHOSPHORUS; Lewis A. Jefes, Salt Lake City, Utah. App. filed Nov. 13, 1917. Making an alloy of a metal and phosphorus in an electric furnace.

1,268,863. AUTOMOBILE OR MOTOR-CYCLE HORN; Ray H. Manson, Elyria, Ohio. App. filed Oct. 8, 1913. Electric horns in which the sound-producing device is controlled by an electric current.

1,268,890. SOUNDER FOR TELEGRAPH CIRCUITS; Fred E. Smith and Le Roy Heflin, Fairfax, Okla. App. filed July 28, 1917. Provides a main-line sounder which obviates the necessity of a local circuit.

1,268,915. BURGLAR ALARM FOR AUTOMOBILES; Hiram A. Beall, Kansas City, Mo. App. filed March 16, 1917. Burglar or theft alarms for automobiles or like vehicles, controlled in the steering post.

1,268,928. PERCOLATOR HEATER; Ora A. Colby, Wilkinsburg, Penn. App. filed April 2, 1913. Electrically heated liquid-containing vessels of the percolator type.

1,268,942. LOCOMOTIVE; George M. Eaton, Pittsburgh, Penn. App. filed Nov. 3, 1916. Electrically propelled locomotives.

1,268,949. METHOD AND APPARATUS FOR AGRICULTURAL ENGINEERING; Reginald A. Fessenden, Brookline, Mass. App. filed Feb. 4, 1918. Consists in generating an electrical discharge, controlling same and placing said electrical discharge in operative relation to the plant whose growth is to be influenced.

1,268,971. LOCOMOTIVE; Rudolph E. Hellmund, Swissvale, Pa. App. filed Oct. 30, 1918. Electric locomotives of the side-rod type.

1,268,972. INSULATOR SUPPORT; Lem E. Hender, Milwaukee, Wis. App. filed Jan. 3, 1918. Provides standard bracket with simple spacing members and fastening means.

1,268,978. GLAND; Robert I. Kinnear, Clydebank, Scotland. App. filed June 5, 1917. An improved gland permitting the passage of a number of cables rendered water-tight by one sealing operation.

Record of Electrical Patents

Notes on United States Patents

1,268,990. MANGLE; Emil Moeller, Chicago, Ill. App. filed July 23, 1917. A hand-operated mangle and an electrical heating element.

1,269,005. RELAY BUZZER; Fred Schoenwolf, Chicago, Ill. App. filed Sept. 8, 1914. Relates to buzzers and the use of an ordinary relay in combination with a dust-proof cover.

1,269,011. METHOD FOR MULTIPLYING THE FREQUENCY OF ELECTRIC CURRENTS; Isaac Shoenberg, London, Eng. App. filed Dec. 27, 1917. An apparatus for increasing the frequency of a multiphase current comprising coils having iron cores of low reluctance connected into one lead of each phase.

1,269,017. CAR; Fred Steffens, St. Joseph, Mo. App. filed March 12, 1917. Relates to motor-driven street cars.

1,269,035. SIGNALING MEANS; Peyton H. Workman, Santa Ana, Cal. App. filed Dec. 13, 1916. Relates to electromagnetically operated signaling means adapted to be attached to an automobile body or similar vehicle.

1,269,052. ELECTRIC HEATER ELEMENT; Farley G. Clark, Paul Ackerman and Charles E. Cansfield, Toronto, Ontario, Can. App. filed July 5, 1917. An electrical resistant molded in a heat-conducting bed of cement or other plastic material.

1,269,053. ELECTRICALLY HEATED TANK OR RESERVOIR; Farley G. Clark, Paul Ackerman, and Charles E. Cansfield, Toronto, Ontario, Can. App. filed July 5, 1917. A tank or reservoir heated by two or more electric heater elements.

1,269,078. ELECTROLYTIC TANK FOR ELECTROCHEMICAL REACTION; Edward H. Hamilton, Trail, B. C., Canada. App. filed Oct. 4, 1917. An electrolytic tank comprising a set of electrodes constituting reacting couples.

1,269,079. AUTOMATIC SWITCH; George F. Hammond, Montecito, Cal. App. filed Oct. 12, 1917. A mechanical switch having electrically operated controlling means.

1,269,096. STORAGE-BATTERY COVER; Edmund Land, Detroit, Mich. App. filed Sept. 17, 1917. A storage-battery cover comprising a closure having a filling hole formed with depending inclosing walls.

1,269,112. AUTOMATIC THERMOSTATIC CONTROL FOR INCUBATORS; Adam Ostheimer, Cleveland, Ohio. App. filed Oct. 9, 1916. Means for automatically maintaining constant the temperature in an incubator.

1,269,121. ELECTRIC SWITCH; Joseph H. Rusby, Nutley, N. J. App. filed May 22, 1913. A surface type of electric switch which is operated by push-buttons to snap the blades into positive engagement with the contact devices.

1,269,128. ELECTRODE; Alexander T. Stuart, Toronto, Ontario, Can. App. filed July 5, 1917. Electrodes for electrolytic and other purposes comprising a multiplicity of current-conducting paths.

1,269,141. PRODUCING CRYSTALLINE ALUMINA; Ray H. White, Niagara Falls, N. Y. App. filed Aug. 18, 1917. Electrically fusing a non-uniform charge whereof the lower portion contains an oxiding addition.

1,269,152. SINGLE-PHASE MOTOR; Julius Pecker, Racine, Wis. App. filed Aug. 24, 1914. Relates to single phase that will be self-starting and will not draw an undesirably large current from the line.

1,269,156. CIRCUIT BREAKER AND SWITCH; George A. Burnham, Saugus, Mass. App. filed April 4, 1916. A circuit breaker having a movable switch member, a latch, a trip coil for the latch and a rotatable latch-engaging element.

1,269,162. STORAGE BATTERY; Walter A. Crowdus, Chicago, Ill. App. filed May 22, 1917. Dry storage batteries in which the electrolyte or excitant employed is non-flowing.

1,269,173. PROCESS OF MAKING BATTERY DEPOLARIZERS; Harry F. French and Raymond C. Benner, Fremont, Ohio. App. filed No. 21, 1916. A battery depolarizer which consists in reducing copper oxide with an excess of sulphur and then reoxidizing the reduced mass in the presence of the excess sulphur.

1,269,181. TELEPHONE SYSTEM; Henry J. Herlink, London, Eng. App. filed Feb. 8, 1916. In a telephone system the combination of a plurality of groups of incoming lines and a plurality of groups of outgoing lines.

1,269,183. CONTROLLER; Albert J. Horton, White Plains, N. Y. App. filed May 11, 1916. Controllers adapted for control of sewing-machine motors.

1,269,214. AUTOMOBILE SIGNAL; Lester E. Prescott and Eugene L. Prescott, South Tacoma, Wash. App. filed July 2, 1917. Provides a signal which may indicate the direction in which the car is to turn.

1,269,222. PREPARING ALUMINOUS ABRASIVES; Lewis E. Saunders and Ray H. White, Niagara Falls, N. Y. App. filed Aug. 18, 1917. In the art of preparing aluminous abrasives by the electric furnace fusion of aluminous materials in presence of carbon, the method of preventing reduction of alumina.

1,269,223. PROCESS OF PURIFYING ALUMINOUS MATERIALS; Lewis E. Saunders, Niagara Falls, N. Y. App. filed Aug. 18, 1917. Purifying aluminous materials, which consists in fusing the same in presence of a sufficient proportion of carbon.

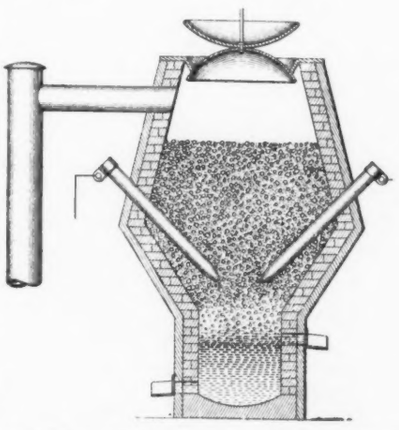
1,269,224. PURIFYING ALUMINOUS MATERIALS; Lewis E. Saunders, Niagara Falls, N. Y. App. filed Aug. 18, 1917. Purifying aluminous materials and producing crystalline alumina, which consists in fusing the impure aluminous charge with proportion of carbon.

1,269,237. SWITCH; Frank E. Wilson, London, Eng. App. filed July 1, 1916. Switches for controling the various lamps such as headlamps, side-lamps, tail-lamps and the like.

1,269,245. AUTOMATIC TELEPHONE SYSTEM; Albert Andersen, Chicago, Ill. App. filed June 7, 1916. Systems that employ meters or other measured service devices.

1,269,246. SIGNAL SYSTEM FOR VEHICLES AND THE LIKE; Francesco P. Anello and Giuseppe Pocoroba, Newark, N. J. App. filed Oct. 20, 1916. Comprising an annunciator having a plurality of movable normally invisible visual signals.

1,269,253. CAR AND ELECTRIC COUPLING CONTROL; Thomas R. Brown, Sparkill, N. Y. App. filed April 10, 1914. Coupling devices for railway cars for connecting fluid pressure conduits and electric train-line circuits.



1,268,849—Process for Making Alloys of Phosphorus

1,269,278. ELECTRIC SWITCH; Clark T. Henderson, Milwaukee, Wis. App. filed Sept. 14, 1914. Relates to series switches in which a single coil operates the contacts.

1,269,344. ELECTRICAL SYSTEM FOR MOTOR VEHICLE; George W. Wacker, Rutherford, N. J. App. filed Nov. 2, 1917. Effects ignition in internal-combustion engines and for lighting purposes.

1,269,400. SWITCH; William W. Dean, Chicago, Ill. App. filed May 11, 1914. Switches designed for use with the steering mechanism of automobiles.